FAS/FHS150-180
Packaged Air-Handling Units with R-410A Refrigerant 60 Hz

Installation, Start-up and Service Instructions

CONTENTS

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes, including ANSI (American National Standards Institute) Z223.1. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

It is important to recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe

practices, which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠DANGER

ELECTRICAL SHOCK HAZARD

Failure to follow this warning will result in personal injury or death.

Before performing service or maintenance operations on unit, turn off main power switch to unit and install lock(s) and lockout tag(s). Ensure electrical service to rooftop unit agrees with voltage and amperage listed on the unit rating plate. Unit may have more than one power switch.

⚠WARNING

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this warning could cause personal injury, death and/or equipment damage.

R-410A refrigerant systems operate at higher pressures than standard R-22 systems. Do not use R-22 service equipment or components on R-410A refrigerant equipment.

⚠WARNING

PERSONAL INJURY AND ENVIRONMENTAL HAZARD

Failure to follow this warning could cause personal injury or death.

Relieve pressure and recover all refrigerant before system repair or final unit disposal.

Wear safety glasses and gloves when handling refrigerants. Keep torches and other ignition sources away from refrigerants and oils.

⚠CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses, and gloves when handling parts and servicing units.

⚠CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution could cause equipment damage.

Ensure voltage listed on unit data plate agrees with electrical supply provided for the unit.

PRE-INSTALLATION

1. The power supply (v, ph, and Hz) must correspond to that specified on unit rating plate.
2. The electrical supply provided by the utility must be sufficient to handle load imposed by this unit.
3. Refer to Installation, General section (page 2) and Fig. 1 for locations of electrical inlets, condensate drain, duct connections, and required clearances before setting unit in place.
4. This installation must conform with local building codes and with the NEC (National Electrical Code) or ANSI (American National Standards Institute)/NFPA (National Fire Protection Association) latest revision. Refer to provincial and local plumbing or wastewater codes and other applicable local codes.

Moving and Storage

To transfer unit from truck to storage site, use a fork truck. Do not stack units more than 2 high during storage. If unit is to be stored for more than 2 weeks before installation, choose a level, dry storage site free from vibration. Do not remove plastic wrap or skid from unit until final installation.

Rigging

All FAS/FHS Series units can be rigged by using the shipping skid. Units are shipped fully assembled. Do not remove shipping skids or protective covering until unit is ready for final placement; damage to bottom panels can result. Use slings and spreader bars as applicable to lift unit.

INSTALLATION

General

Allow the following clearances for service access and airflow:

- Rear: 2-1/2 ft (762 mm) [2-1/2 ft (762 mm) with electric heat accessory]
- Front: 2-1/2 ft (762 mm)
- Right Side: 3-1/2 ft (1067 mm)
- Left Side: 2-1/2 ft (762 mm)

For units equipped with an economizer, refer to the accessory installation instructions for additional clearance requirements. Be sure floor, wall, or ceiling can support unit weight (Tables 1-4). See Fig. 1 for dimensions.

Uncrating

Move unit as near as possible to final location before removing shipping skid.

Remove metal banding, top skid, and plastic wrap. Examine unit for shipping damage. If shipping damage is evident, file claim with transportation agency. Remove base skid just prior to actual installation.

Check nameplate information against available power supply and model number description in Fig. 2.

NOTE: Be sure to remove the foam shipping pad from the thermostatic expansion valve (TXV). Verify that it has been removed. (See Fig. 3.)

Accessories

Refer to instructions shipped with each accessory for specific information.

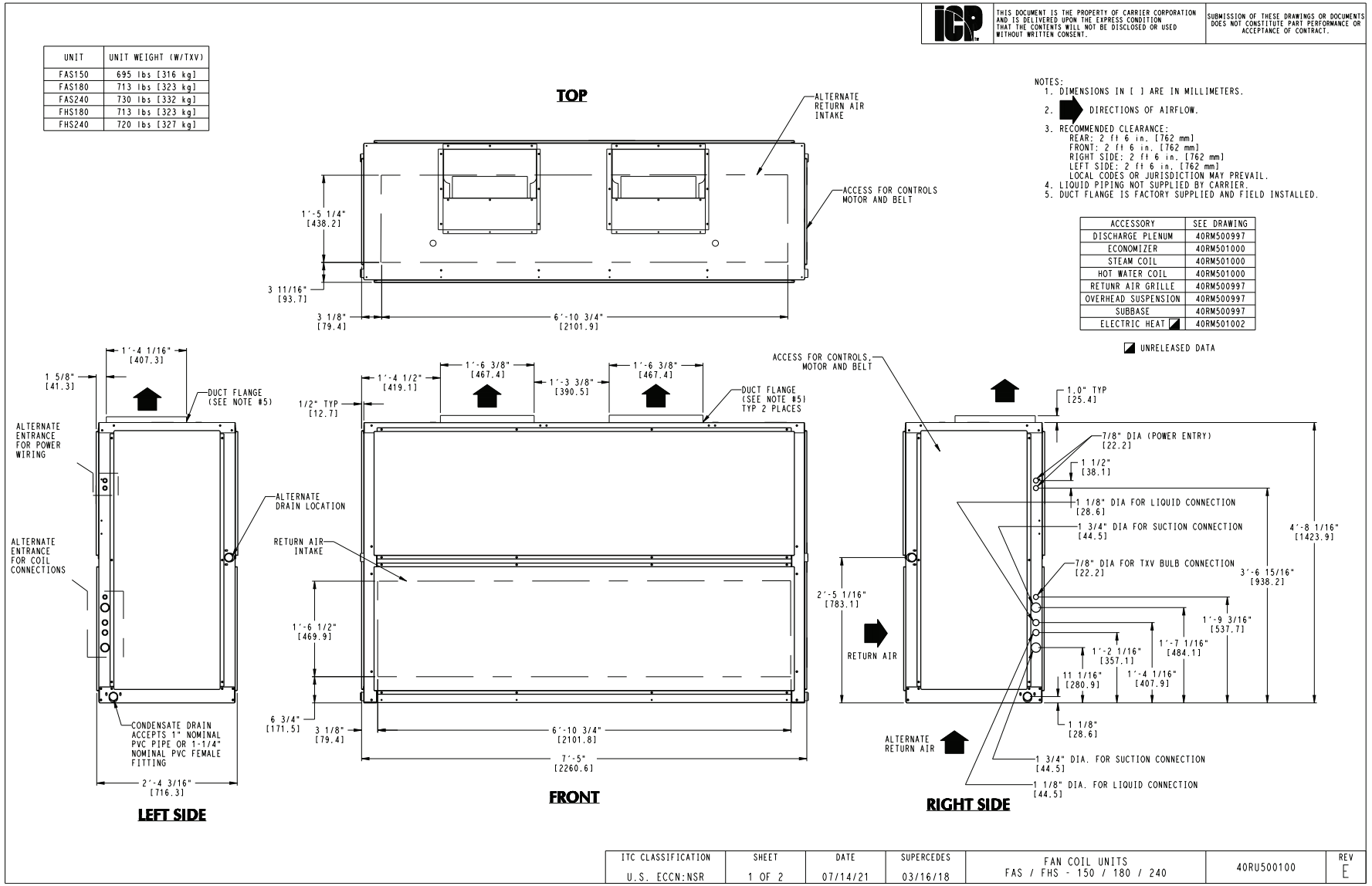
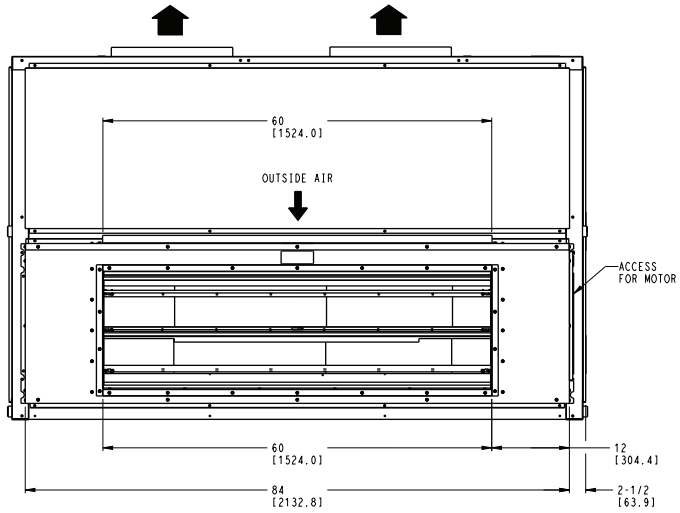
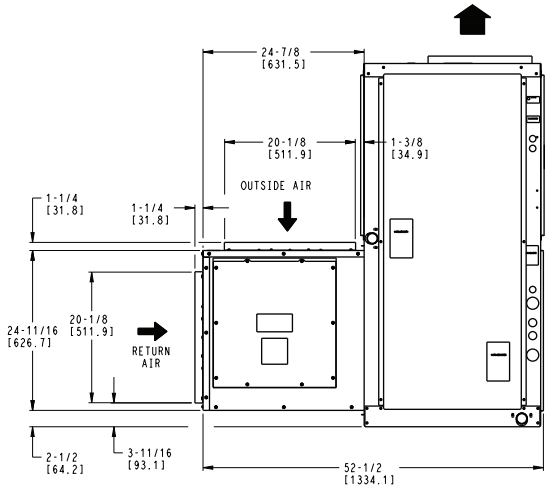


Fig. 1 — Dimensions — Size 150 and 180



FRONT

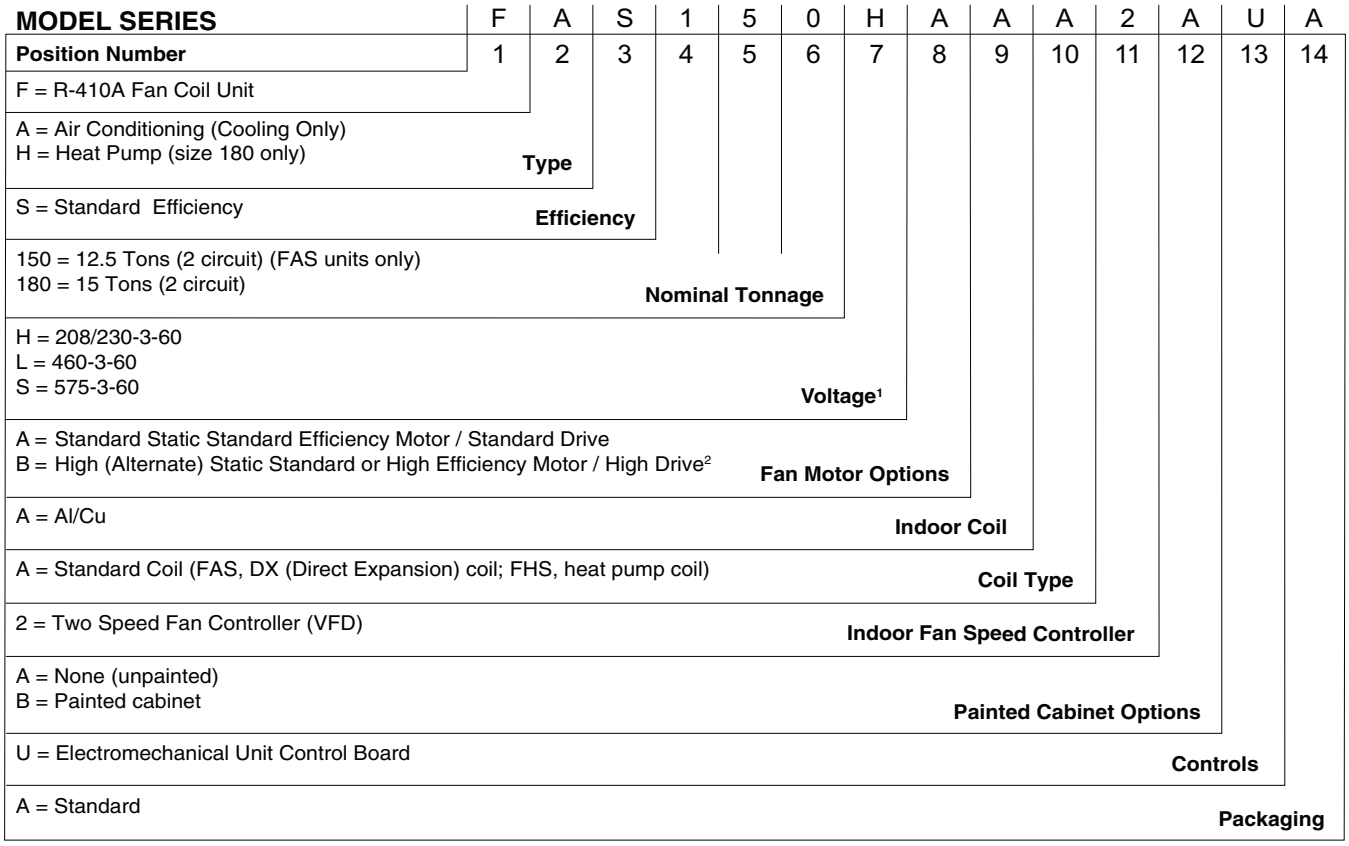


RIGHT SIDE

UNIT WITH ECONOMIZER

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	FAN COIL UNITS		REV
U.S. ECCN:NSR	2 OF 2	07/14/21	03/16/18	FAS / FHS - 150 / 180 / 240	40RU500100	E

Fig. 1 —Dimensions — Size 150 and 180 (cont)



[1] There are no multi-voltage units with the optional 2-speed indoor fan motor / VFD controller. VFD controllers are dedicated voltage devices for 208/230v, 460v, and 575v.

[2] For FAS, standard efficiency on size 150, voltages 208-230v and 460v. High efficiency on size 180, as well as size 150, 575v. For FHS, high efficiency only.

Fig. 2 — Model Number Nomenclature

Table 1 — FAS150-180 Physical Data, English — Cooling Units

UNIT FAS	150	180
NOMINAL CAPACITY (tons)	12-1/2	15
OPERATING WEIGHT (lb)		
Base Unit with TXV	695	713
Plenum	225	225
FANS		
Qty...Diam. (in.)	2...15	2...15
Nominal Airflow (cfm)	5000	6000
Airflow Range (cfm)	3750-6250	4500-7500
Nominal Motor Hp (Standard Motor)		
208/230-3-60 and 460-3-60	2.9	3.7
575-3-60	3.0	3.0
Motor Speed (rpm)		
208/230-3-60 and 460-3-60	1725	1725
575-3-60	1725	1725
REFRIGERANT	R-410A	R-410A
Operating Charge (lb) (approx per circuit)[a]	2.0/2.0	2.5/2.5
DIRECT EXPANSION COIL	Enhanced Copper Tubes, Aluminum Sine-Wave Fins	Enhanced Copper Tubes, Aluminum Sine-Wave Fins
Max Working Pressure (psig)	650	650
Face Area (sq ft)	13.25	17.67
No. of Splits	2	2
No. of Circuits per Split	12	16
Split Type...Percentage	Face...50/50	Face...50/50
Rows...Fins/in.	4...15	4...15
PIPING CONNECTIONS		
Quantity...Size (in.)		
DX Coil — Suction (ODF)	2...1-1/8	2...1-1/8
DX Coil — Liquid Refrigerant (ODF)	2...5/8	2...5/8
Steam Coil, In (MPT)	1...2-1/2	1...2-1/2
Steam Coil, Out (MPT)	1…1-1/2	1…1-1/2
Hot Water Coil, In (MPT)	1...2	1...2
Hot Water Coil, Out (MPT)	1...2	1...2
Condensate (PVC)	1...1-5/8 ODM / 1-1/4 IDF	1...1-5/8 ODM / 1-1/4 IDF
FILTERS	Throwaway — Factory Supplied	Throwaway — Factory Supplied
Quantity...Size (in.)	4...16 x 20 x 2 4...16 x 24 x 2	4...16 x 20 x 2 4...16 x 24 x 2
Access Location	Either Side	Either Side
STEAM COIL[b]		
Max Working Pressure (psig at 260°F)	20	20
Total Face Area (sq ft)	13.33	13.33
Rows...Fins/in.	1...10	1...10
HOT WATER COIL[b]		
Max Working Pressure (psig)	150	150
Total Face Area (sq ft)	13.33	13.33
Rows...Fins/in.	2...8.5	2...8.5
Water Volume		
(gal)	13.9	13.9
(ft^3)	1.85	1.85

NOTE(S):

a Units are shipped without refrigerant charge.
b Field-installed accessory only.

LEGEND

DX — Direct Expansion
IDF — Inside Diameter, Female
ODF — Outside Diameter, Female
ODM — Outside Diameter, Male
TXV — Thermostatic Expansion Valve

Table 2 — FAS150-180 Physical Data, SI — Cooling Units

UNIT FAS	150	180
NOMINAL CAPACITY (kW)	43	52
OPERATING WEIGHT (kg)		
Base Unit with TXV	315	323
Plenum	102	102
FANS		
Qty...Diam. (mm)	2...381	2...381
Nominal Airflow (L/s)	2360	2831
Airflow Range (L/s)	1770-2949	2124-3539
Nominal Motor Hp (Standard Motor)		
208/230-3-60 and 460-3-60	2.16	2.16
575-3-60	2.24	2.24
Motor Speed (r/s)		
208/230-3-60 and 460-3-60	28.8	28.8
575-3-60	28.8	28.8
REFRIGERANT		
Operating Charge (kg) (approx per circuit)[a]	0.90/0.90	1.13/1.13
DIRECT EXPANSION COIL	Enhanced Copper Tubes, Aluminum Sine-Wave Fins	Enhanced Copper Tubes, Aluminum Sine-Wave Fins
Max Working Pressure (kPag)	4481	4481
Face Area (sq m)	0.93	1.64
No. of Splits	2	2
No. of Circuits per Split	12	16
Split Type...Percentage	Face...50/50	Face...50/50
Rows...Fins/m	4...591	4...591
PIPING CONNECTIONS		
Quantity...Size (in.)		
DX Coil — Suction (ODF)	2...1-1/8	2...1-1/8
DX Coil — Liquid Refrigerant (ODF)	2...5/8	2...5/8
Steam Coil, In (MPT)	1...2-1/2	1...2-1/2
Steam Coil, Out (MPT)	1…1-1/2	1…1-1/2
Hot Water Coil, In (MPT)	1...2	1...2
Hot Water Coil, Out (MPT)	1...2	1...2
Condensate (PVC)	1...1-5/8 ODM / 1-1/4 IDF	1...1-5/8 ODM / 1-1/4 IDF
FILTERS	Throwaway — Factory Supplied	Throwaway — Factory Supplied
Quantity...Size (mm)	4...406 x 508 x 51 4...406 x 610 x 51	4...406 x 508 x 51 4...406 x 610 x 51
Access Location	Either Side	Either Side
STEAM COIL[b]		
Max Working Pressure (kPag at 126°C)	138	138
Total Face Area (sq m)	1.24	1.24
Rows...Fins/m	1...394	1...394
HOT WATER COIL[b]		
Max Working Pressure (kPag)	1034	1034
Total Face Area (sq m)	1.24	1.24
Rows...Fins/m	2...335	2...335
Water Volume		
(L)	52.6	52.6
(m^3)	0.052	0.052

NOTE(S):

a Units are shipped without refrigerant charge.
b Field-installed accessory only.

LEGEND

DX — Direct Expansion
IDF — Inside Diameter, Female
ODF — Outside Diameter, Female
ODM — Outside Diameter, Male
TXV — Thermostatic Expansion Valve

Table 3 — FHS180 Physical Data, English — Heat Pump Units

UNIT FHS	180
NOMINAL CAPACITY (tons)	15
OPERATING WEIGHT (lb)	
Base Unit with TXV	713
Plenum	225
FANS	
Qty...Diam. (in.)	2...15
Nominal Airflow (cfm)	5625
Airflow Range (cfm)	4500-7500
Nominal Motor Hp (Standard Motor)	
208/230-3-60 and 460-3-60	3.7
575-3-60	3.0
Motor Speed (rpm)	
208/230-3-60 and 460-3-60	1725
575-3-60	1725
REFRIGERANT	
Operating Charge (lb) (approx per circuit)[a]	3.0/3.0
DIRECT EXPANSION COIL	Enhanced Copper Tubes, Aluminum Sine-Wave Fins
Max Working Pressure (psig)	650
Face Area (sq ft)	16.56
No. of Splits	2
No. of Circuits per Split	10
Split Type...Percentage	Face...50/50
Rows...Fins/in.	4...15
PIPING CONNECTIONS	
Quantity...Size (in.)	
DX Coil — Suction (ODF)	2...1-1/8
DX Coil — Liquid Refrigerant (ODF)	2...5/8
Steam Coil, In (MPT)	1...2-1/2
Steam Coil, Out (MPT)	1…1-1/2
Hot Water Coil, In (MPT)	1...2
Hot Water Coil, Out (MPT)	1...2
Condensate (PVC)	1...1-5/8 ODM / 1-1/4 IDF
FILTERS	Throwaway — Factory Supplied
Quantity...Size (in.)	4...16 x 20 x 2
	4...16 x 24 x 2
Access Location	Either Side
STEAM COIL[b]	
Max Working Pressure (psig at 260°F)	20
Total Face Area (sq ft)	13.33
Rows...Fins/in.	1...10
HOT WATER COIL[b]	
Max Working Pressure (psig)	150
Total Face Area (sq ft)	13.33
Rows...Fins/in.	2...8.5
Water Volume	
(gal)	13.9
(ft^3)	1.85

NOTE(S):

a Units are shipped without refrigerant charge.
b Field-installed accessory only.

LEGEND

DX — Direct Expansion
IDF — Inside Diameter, Female
ODF — Outside Diameter, Female
ODM — Outside Diameter, Male
TXV — Thermostatic Expansion Valve

Table 4 — FHS180 Physical Data, SI — Heat Pump Units

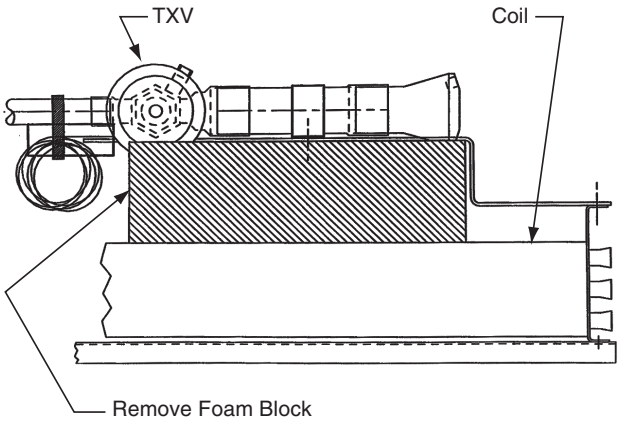
UNIT FHS	180
NOMINAL CAPACITY (kW)	52
OPERATING WEIGHT (kg)	
Base Unit with TXV	323
Plenum	102
FANS	
Qty...Diam. (mm)	2...381
Nominal Airflow (L/s)	2655
Airflow Range (L/s)	2124-3539
Nominal Motor Hp (Standard Motor)	
208/230-3-60 and 460-3-60	2.76
575-3-60	2.24
Motor Speed (r/s)	
208/230-3-60 and 460-3-60	28.8
575-3-60	28.8
REFRIGERANT	
Operating Charge (kg) (approx per circuit)[a]	1.36/1.36
DIRECT EXPANSION COIL	Enhanced Copper Tubes, Aluminum Sine-Wave Fins
Max Working Pressure (kPag)	4482
Face Area (sq m)	1.54
No. of Splits	2
No. of Circuits per Split	10
Split Type...Percentage	Face...50/50
Rows...Fins/m	4...591
PIPING CONNECTIONS	
Quantity...Size (in.)	
DX Coil — Suction (ODF)	2...1-1/8
DX Coil — Liquid Refrigerant (ODF)	2...5/8
Steam Coil, In (MPT)	1...2-1/2
Steam Coil, Out (MPT)	1…1-1/2
Hot Water Coil, In (MPT)	1...2
Hot Water Coil, Out (MPT)	1...2
Condensate (PVC)	1...1-5/8 ODM / 1-1/4 IDF
FILTERS	Throwaway — Factory Supplied
Quantity...Size (mm)	4...406 x 508 x 51
	4...406 x 610 x 51
Access Location	Either Side
STEAM COIL[b]	
Max Working Pressure (kPag at 126°C)	138
Total Face Area (sq m)	1.24
Rows...Fins/m	1...394
HOT WATER COIL[b]	
Max Working Pressure (kPag)	1034
Total Face Area (sq m)	1.24
Rows...Fins/m	2...335
Water Volume	
(L)	52.6
(m^3)	0.052

NOTE(S):

a Units are shipped without refrigerant charge.
b Field-installed accessory only.

LEGEND

DX — Direct Expansion
IDF — Inside Diameter, Female
ODF — Outside Diameter, Female
ODM — Outside Diameter, Male
TXV — Thermostatic Expansion Valve



LEGEND
TXV — Thermostatic Expansion Valve

Fig. 3 — Foam Block Location

Rated Indoor Airflow (cfm)

Tables 5-7 list the rated indoor airflow used for the AHRI (Air-Conditioning, Heating, and Refrigeration Institute) efficiency rating for the units covered in this document.

Table 5 — CAS**G/H/MN with FAS150-180**

MODEL NUMBER	FULL LOAD AIRFLOW (CFM)
CAS150G/H/M/N — FAS150	4400
CAS180G/H/M/N — FAS180	6000

Table 6 — CAS**T/U with FAS150-180**

MODEL NUMBER	FULL LOAD AIRFLOW (CFM)
CAS150T/U — FAS150	4400
CAS180T/U — FAS180	5625

Table 7 — CHS with FHS180

MODEL NUMBER	FULL LOAD AIRFLOW (CFM)
CHS180 — FHS180	5625

Unit Positioning

The unit can be mounted on the floor for vertical application with return air entering the face of the unit and supply air discharging vertically through the top of the unit. The unit can also be applied in a horizontal arrangement with return air entering horizontally and the supply air discharging horizontally. When applying the unit in a horizontal arrangement, ensure the condensate drain pan is located at the bottom center of the unit for adequate condensate disposal. See Fig. 4 for condensate connections for each unit position.

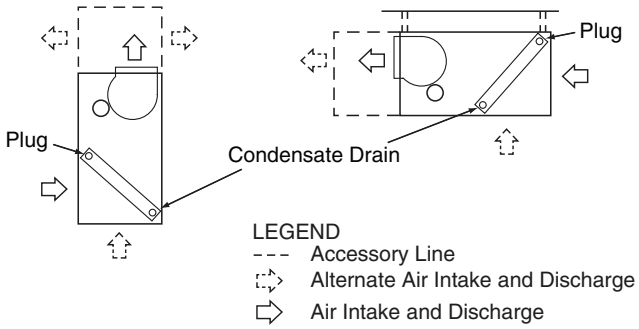


Fig. 4 — Typical Unit Positioning

IMPORTANT: Do NOT attempt to install unit with return air entering top panel of unit. Condensate will not drain from unit.

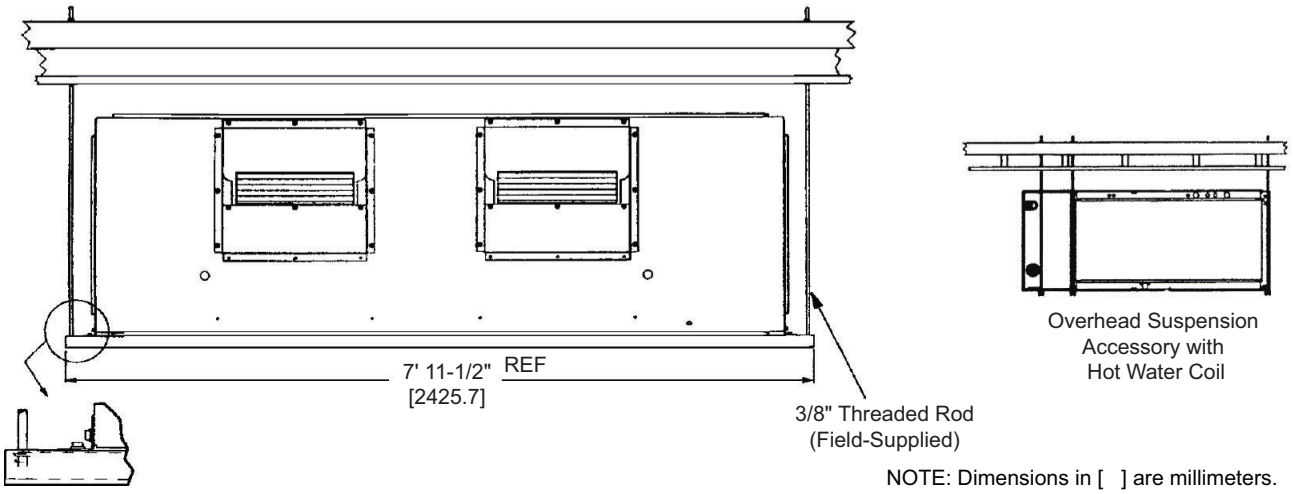
Typical positioning and alternate return air locations are shown in Fig. 4. Alternate return air locations can be used by moving the unit panel from the alternate return air location to the standard return air location. Refer to overhead suspension accessory drawing (see Fig. 5) for preferred suspension technique. The unit needs support underneath to prevent sagging.

Unit Isolation

Where extremely quiet operation is essential, install isolators between floor and base of unit, or between ceiling and top section of unit.

Be sure that unit is level and adequately supported. Use channels at front and sides of unit for reference points when leveling.

IMPORTANT: Do not bury refrigerant piping underground.



NOTE: Dimensions in [ ] are millimeters.

Fig. 5 — Preferred Suspension Technique

Refrigerant Piping

See Tables 1-4 for refrigerant pipe connection sizes. For ease in brazing, it is recommended that all internal solder joints be made before unit is placed in final position.

The FAS/FHS direct-expansion units have internal factory-installed thermostatic expansion valves (TXVs), distributors, and nozzles for use with R-410A. See Table 8 for part numbers. Knockouts are provided in the unit corner posts for FAS/FHS refrigerant piping. See Fig. 6, which also lists recommended knockouts and access holes to use for each FAS/FHS unit size. Recommended fittings are listed in Table 9.

The sensor bulb capillary tubes must be routed from the TXVs inside the unit through one of the piping access holes. Clamp the TXV sensor bulb on a vertical portion of the suction line, outside the unit. (See Fig. 7.)

Refrigerant Piping Access

The FAS/FHS series units come with standard knockouts for refrigerant piping. These knockouts are located on both sides of the unit for installation flexibility. The standard knockouts provide sufficient access to the unit's coils for all FAS150 and 180 units. FHS180 units require additional holes that must be field-fabricated to accommodate the piping. See Fig. 6 for the positions and dimensions of the additional access holes required for 575J*16H units. Recommended access hole use is also listed for all units. Note that Fig. 6 shows the access holes on the control-box side of the unit; this is the side of the unit with the coil headers, so it is used most often for piping access.

NOTE: Be sure to remove the foam shipping pad from the TXV. Verify that it has been removed. (See Fig. 3.)

IMPORTANT: Never attach the sensor to the suction manifold. Do NOT mount the sensor on a trapped portion of the suction line.

The FAS/FHS series evaporator coils have a face-split design. Ensure that lower circuit of coil is first on/last off when connected to the condensing unit and/or system controls. (See Fig. 8.)

External TXV equalizer connections are provided and factory-brazed into the coil suction manifolds.

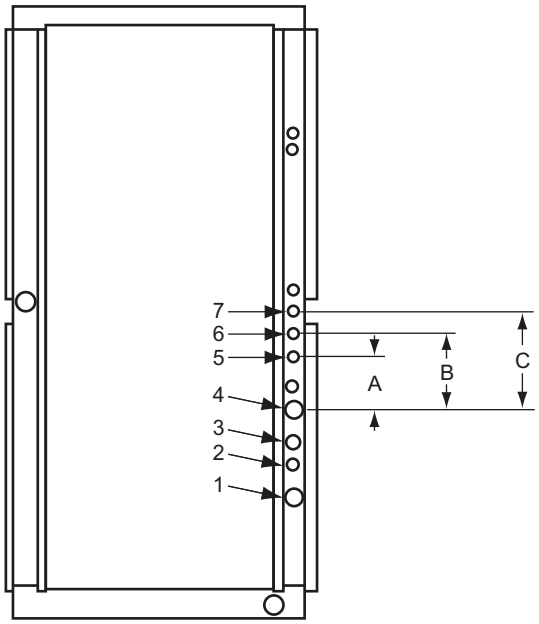
If suction line must be horizontal, clamp bulb to suction line at least 45 degrees above bottom, at approximately the 4 o'clock or 8 o'clock position. (See Fig. 9.)

Table 8 — Factory-Installed Nozzle and Distributor Data[a]

UNIT	COIL TYPE STD	TXV QTY...PART NO.	DISTRIBUTOR QTY... PART NO.	FEEDER TUBES PER DISTRIBUTOR[b] QTY...SIZE (in.)	NOZZLE QTY...PART NO.
FAS150	4 Row	2...1193965 2...HXAE-6-KX	2...1178407 2...1113	12...3/16	2...1178409 2...G3
FAS180	4 Row	2...1178406 2...BBIZE—6—GA	2...1178412 2...1136	16...3/16	2...1178410 2...G4
FHS180	4 Row	2...1183553 2...BBIZE—8—GA	2...1178407 2...1113	10...3/16	2...1179769 2...G5

NOTE(S):

a Hot gas bypass applications require field-supplied auxiliary side connector.
b Feeder tube size is 1/4 in. (6.35 mm).



UNIT	USE HOLE NUMBERS[a]	FIELD-FABRICATED HOLE DIAMETERS in. (mm)			FIELD-FABRICATED HOLE POSITION DIMENSIONS, in. (mm)		
		NO. 5	NO. 6	NO.7	A	B	C
FAS150/180	1, 2, 3, 4	—	—	—	—	—	—
FHS180	3[b], 5, 6, 7	1-1/8 (28.6)	1-1/8 (28.6)	1-3/4 (44.5)	3.25 (82.6)	6.125 (155.6)	10.38 (263.7)

NOTE(S):

a Access hole knockouts 1-4 are factory-supplied.
b Must be enlarged from 1-1/8 in. (28.6 mm) to 1-3/4 in. (44.5 mm)

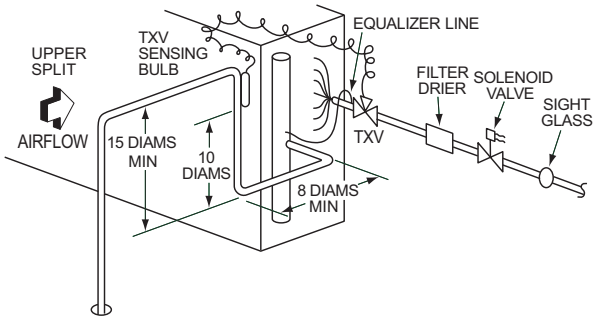
Fig. 6 — Refrigerant Piping Access Holes

Table 9 — Fitting Requirements

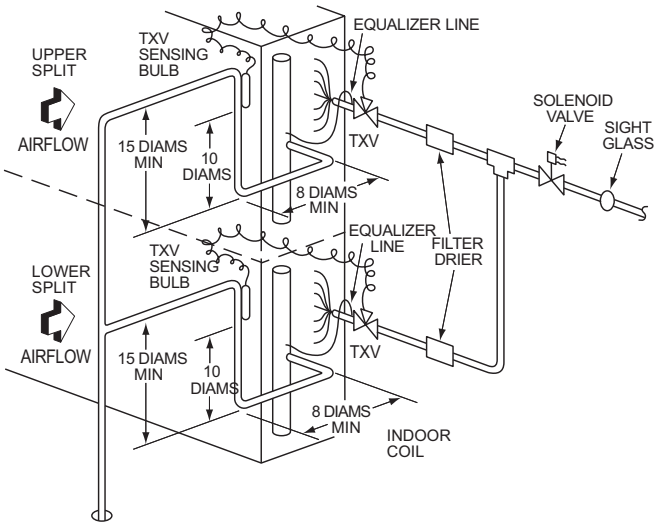
UNIT	ACCESS HOLE NO.[a]	CONNECTION TYPE	CIRCUIT	FITTING REQUIRED[b] (in.)
FAS150	1	Suction	Lower	1-1/8 Street Elbow 1-1/8 Nipple, 7-5/8 L 1-1/8 Long Radius Elbow
	2	Liquid	Lower	5/8 Street Elbow 5/8 Nipple, 1-7/16 L 5/8 Long Radius Elbow
	3	Liquid	Upper	5/8 Street Elbow 5/8 Nipple, 11-1/2 L 5/8 Long Radius Elbow
	4	Suction	Upper	1-1/8 Nipple, 5-5/8 L 1-1/8 Long Radius Elbow 1-1/8 Nipple, 13 L 1-1/8 Long Radius Elbow
FAS180	1	Suction	Lower	1-1/8 Street Elbow 1-1/8 Nipple, 72-3/4 L 1-1/8 Long Radius Elbow
	2	Liquid	Lower	5/8 Street Elbow 5/8 Nipple, 1-3/8 L 5/8 Long Radius Elbow
	3	Liquid	Upper	5/8 Street Elbow 5/8 Nipple, 11-1/2 L 5/8 Long Radius Elbow
	4	Suction	Upper	1-1/8 Nipple, 5-5/8 L 1-1/8 Long Radius Elbow 1-1/8 Nipple, 13 L 1-1/8 Long Radius Elbow
FHS180	3	Suction	Lower	1-1/8 Nipple, 3 L 1-1/8 Long Radius Elbow
	5	Suction	Lower	5/8 Nipple, 2-7/8 L 5/8 45° Elbow 5/8 Nipple, 1-5/8 L 5/8 Long Radius Elbow
	6	Liquid	Upper	5/8 Nipple, 2-7/8 L 5/8 45° Elbow 5/8 Nipple, 4-1/4 L 5/8 Long Radius Elbow
	7	Suction	Upper	1-1/8 Nipple, 5 L 1-1/8 45° Elbow 1-1/8 Nipple, 8-3/4 L 1-1/8 Long Radius Elbow

NOTE(S):

a See Fig. 7 for access hole location by number.
b Fittings are listed in order from header or tee stub connection out to access hole in corner support post.



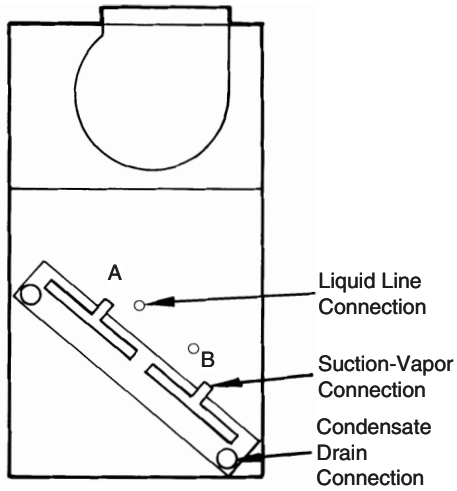
Single Circuit Coil Piping Configuration - FAS/FHS 072, 091
For single compressor condensing units.



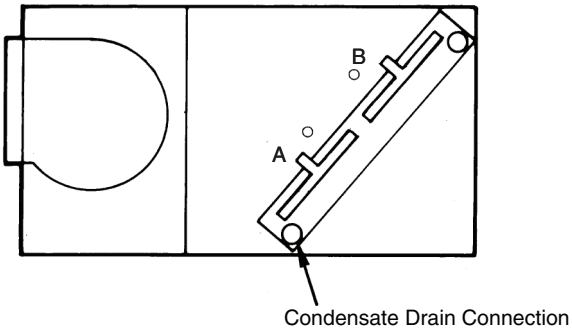
Dual Circuit Coil Piping Configuration - FAS/FHS 120-180
For single compressor condensing units

LEGEND
TXV — Thermostatic Expansion Valve
NOTE: Component location arrangement shown for field installation of sight glasses, solenoid valves, filter driers, and TXV sensing bulbs. The TXVs and equalizer lines are factory-installed.

Fig. 7 — Face-Split Coil and Liquid Line Piping (Typical)

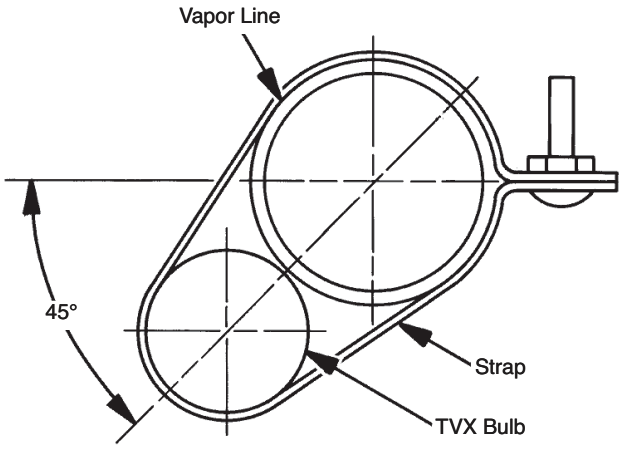


First On/Last Off = B
Vertical Installation



First On/Last Off = A
Horizontal Installation

Fig. 8 — Typical Evaporator Coil Connections (FAS/FHS)



LEGEND

TXV — Thermostatic Expansion Valve

NOTE: The 8 o'clock position is shown above.

Fig. 9 — TXV Sensing Bulb Location

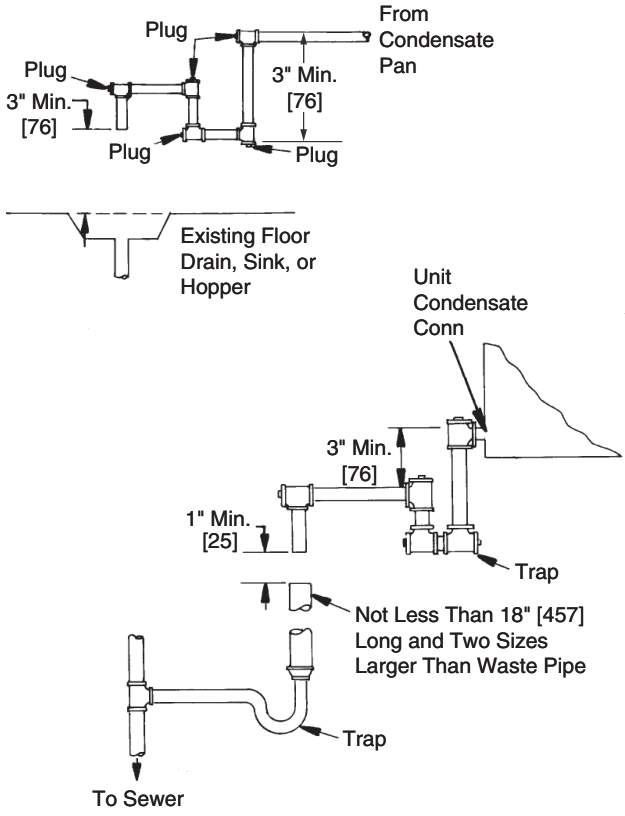
Condensate Drain

Install a trapped condensate drain line to unit connection as shown in Fig. 10. The unit drain connection is a PVC stub. (See Fig. 11.) Some areas may require an adapter to connect to either galvanized steel or copper pipe. For these applications, install a field-supplied threaded PVC adapter.

NOTE: A trap must be installed in the condensate drain line to ensure that the static pressure of fans is balanced with the water column in the drain line and that condensate can drain completely from pan. Without a trap, air can be drawn up drain line until water level in condensate pan becomes equal to static pressure created by fans, preventing complete drainage. Conditions will worsen as filters become dirty.

Install clean-out plugs in trap. Pitch drain line downward to an open floor drain or sump. Provide service clearance around drain line to permit removal of unit panels. Observe all local sanitary codes.

As shipped, the unit's condensate drain pan is NOT sloped towards the drain connection. The pan slope must be changed to pitch towards the side of the unit with the drain connection. (See Fig. 11.) Loosen the 2 screws next to the drain outlet at both ends of the unit, push drain pan down in the slots near the drain connection, and up in the slots on the opposite end. Re-tighten screws. The pan should have a pitch of at least 1/4 in. over its length toward the drain connection.



NOTE: Dimensions in [ ] are in millimeters

Fig. 10 — Condensate Drain

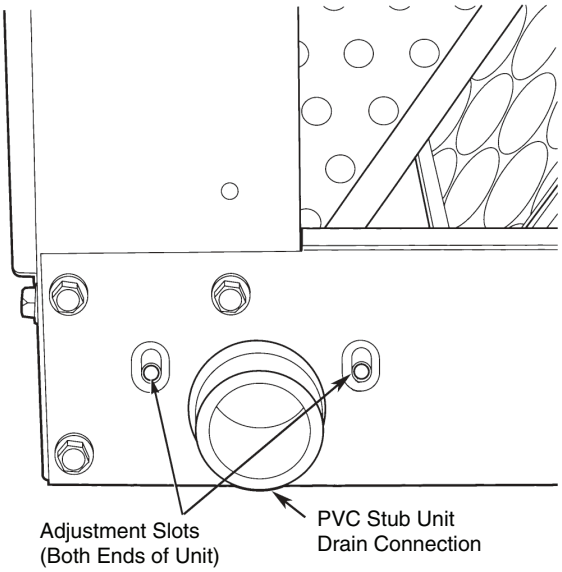


Fig. 11 — Drain Pan Slope Adjustment

Fan Motors and Drives

Motor and drive packages are factory installed in all units. The motor and drive packages consist of the following items:

1 — fan motor

1 — adjustable motor pulley

1 — fan pulley

2 — matched fan belts
(FAS150/180, FHS180 units)

For instructions on changing fan rotation, changing drive speeds and adjusting drives, see “Pulley and Drive Adjustment” on page 27.

Power Supply and Wiring

Check the unit data plate to ensure that available power supply matches electrical characteristics of the unit. Provide a disconnect switch with an integrated lock-out feature of size required to provide adequate fan motor starting current. See Table 10 for unit electrical data.

Table 10 — Electrical Data — Two Speed Motors[a]

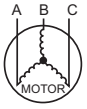
UNIT	VOLTAGE	IFM TYPE	VOLTAGE LIMITS[b]		FAN MOTOR			POWER SUPPLY[c]	
			Min	Max	Hp	kW	FLA[d]	MCA	MOCP
FAS150	208/230	STD	187	253	2.9	2.16	8.6	11.0	15
		MED	187	253	2.9	2.16	8.6	11.0	15
		HIGH	187	253	3.7	2.76	10.8	14.0	20
	460	STD	414	506	2.9	2.16	3.8	5.0	15
		MED	414	506	2.9	2.16	3.8	5.0	15
		HIGH	414	506	3.7	2.76	4.9	7.0	15
	575	STD	518	632	3.7	2.76	4.5	6.0	15
		MED	518	632	3.7	2.76	4.5	6.0	15
		HIGH	518	632	5.0	3.73	8.0	10.0	15
FAS180 FHS180	208/230	STD	187	253	3.7	2.76	10.8	14.0	20
		MED	187	253	3.7	2.76	10.8	14.0	20
		HIGH	187	253	5.0	3.73	18.0	23.0	40
	460	STD	414	506	3.7	2.76	4.9	7.0	15
		MED	414	506	3.7	2.76	4.9	7.0	15
		HIGH	414	506	5.0	3.73	9.1	12.0	20
	575	STD	518	632	3.7	2.76	4.5	6.0	15
		MED	518	632	3.7	2.76	4.5	6.0	15
		HIGH	518	632	5.0	3.73	8.0	10.0	15

NOTE(S):

a Installation with Accessory Electric Heaters: Size the Field Power Wiring between the heater TB1 and the FAS/FHS indoor fan motor per NEC Article 430-28 (1) or (2) (depends on length of conduit between heater enclosure and FAS/FHS power entry location). Install wires in field-installed conduit.
b Motors are designed for satisfactory operation within 10% of normal voltage shown. Voltages should not exceed the limits shown in the Voltage Limits column.
c Minimum circuit amps (MCA) and maximum overcurrent protection (MOCP) values are calculated in accordance with NEC Article 440.
d Motor FLA values are established in accordance with Underwriters Laboratories (UL). Standard 1995.

$$\text{\% Voltage Imbalance} = 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 230-3-60



AB = 224 v
BC = 231 v
AC = 226 v

$$\text{Average Voltage} = \frac{(224 + 231 + 226)}{3} = \frac{681}{3} = 227$$

Determine maximum deviation from average voltage.
(AB) 227-224 = 3 v
(BC) 231-227 = 4 v
(AC) 227-226 = 1 v
Maximum deviation is 4 v.
Determine percent of voltage imbalance.

$$\text{\% Voltage Imbalance} = 100\text{x} \frac{4}{227} = 1.78\%$$

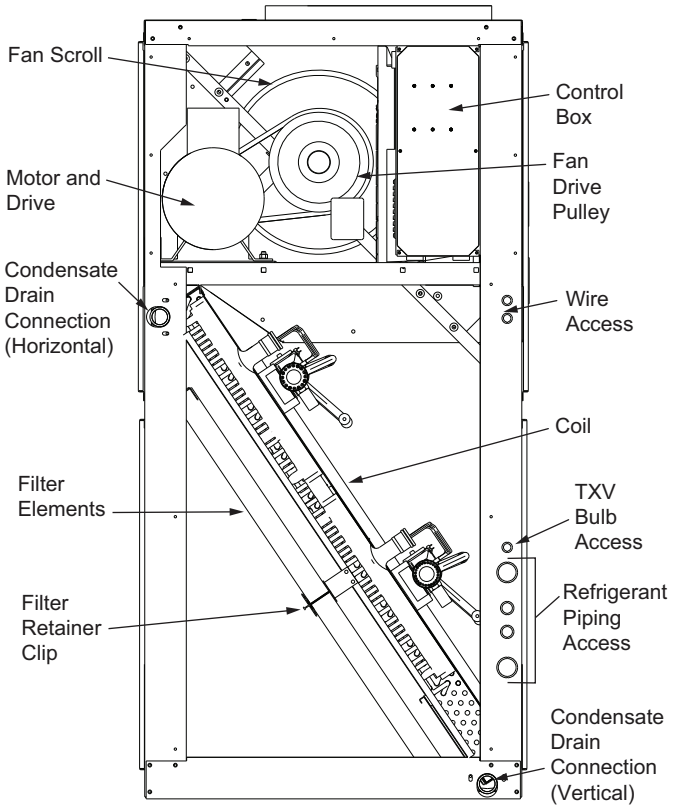
This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

LEGEND

FLA — Full Load Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection

Install disconnect switch and power wiring in accordance with all applicable local codes. See Fig. 12-13 and the unit label diagram. For units with motor sizes less than 5 Hp (3.7 kW), connect power wiring to unit with no. 10 ring terminal. For units with motor sizes of 5 Hp (3.7 kW) or more, connect power wiring with 1/4 in. ring terminal.



LEGEND
TXV —Thermostatic Expansion Valve

Fig. 12 — Wiring and Service Access (Side Panel Removed)

The FAS/FHS size 150-180 units that have motors wired for 460 v, 3 ph, 60 Hz operation can be field-converted to 208/230 v, 3 ph, 60 Hz operation. Rewire the motor according to the diagram plate on the motor. After reconfiguring the motor, mark the motor specifying 208 v or 230 v operation replacing the 460 v sticker information on the units' corner post.

Fan motors are factory-installed on all units. The control box (see Fig. 13) contains a Unit Control Board (UCB) that receives thermostat commands from the thermostat (through the Thermostat Connection Board [TSTAT CB]) and outputs these commands to the condensing unit (through the Indoor Connection Board [IDCB]). The control box also contains a high voltage terminal block and fuses that provide overcurrent protection to the Variable Frequency Drive.

Complete 24-v control circuit wiring. Wire the thermostat to TSTAT CB terminal block (see Fig. 13), according to Fig. 14 and the unit label diagram. If the air handler is part of a split system, complete the wiring from the condensing unit to IDCB terminal block (see Fig. 13). Refer to Fig. 14 and the unit label diagram.

THREE STAGE OPERATION

All units are factory shipped for 2-stage cooling operation. To convert a unit to 3-stage operation, see Fig. 15 and adjust the following wires between the control board and two terminal strips on the side of the control box:

1. Remove gray wire from Thermostat CB terminal X.
2. Move orange wire from Thermostat CB terminal Y2 to terminal X.
3. Make connections of blue wire included in factory harness. Connect one end to Thermostat CB terminal Y2 and the other to Indoor Connection Board terminal Y2.
4. Move orange wire from Indoor Connection Board terminal Y2 to terminal X.

The 3-stage system will run the fan at low speed with a G, Y1, and Y1+Y2 call, and at high speed with a call for Y1, Y2, and Y3. A thermostat with 3 cooling stage capability is required for this system configuration.

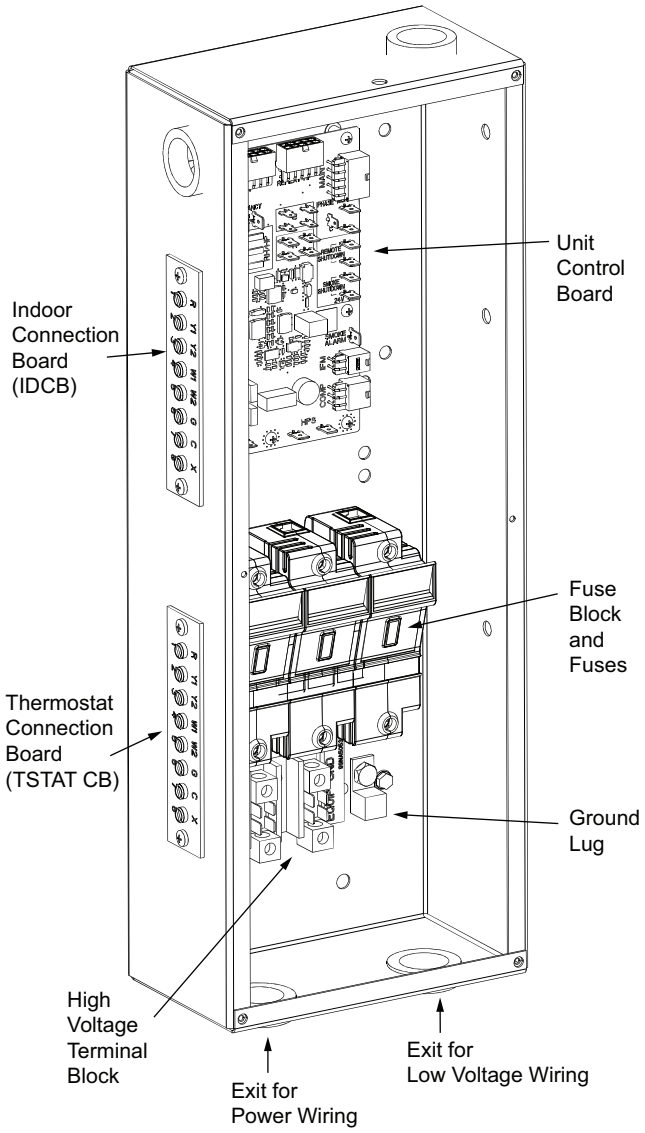
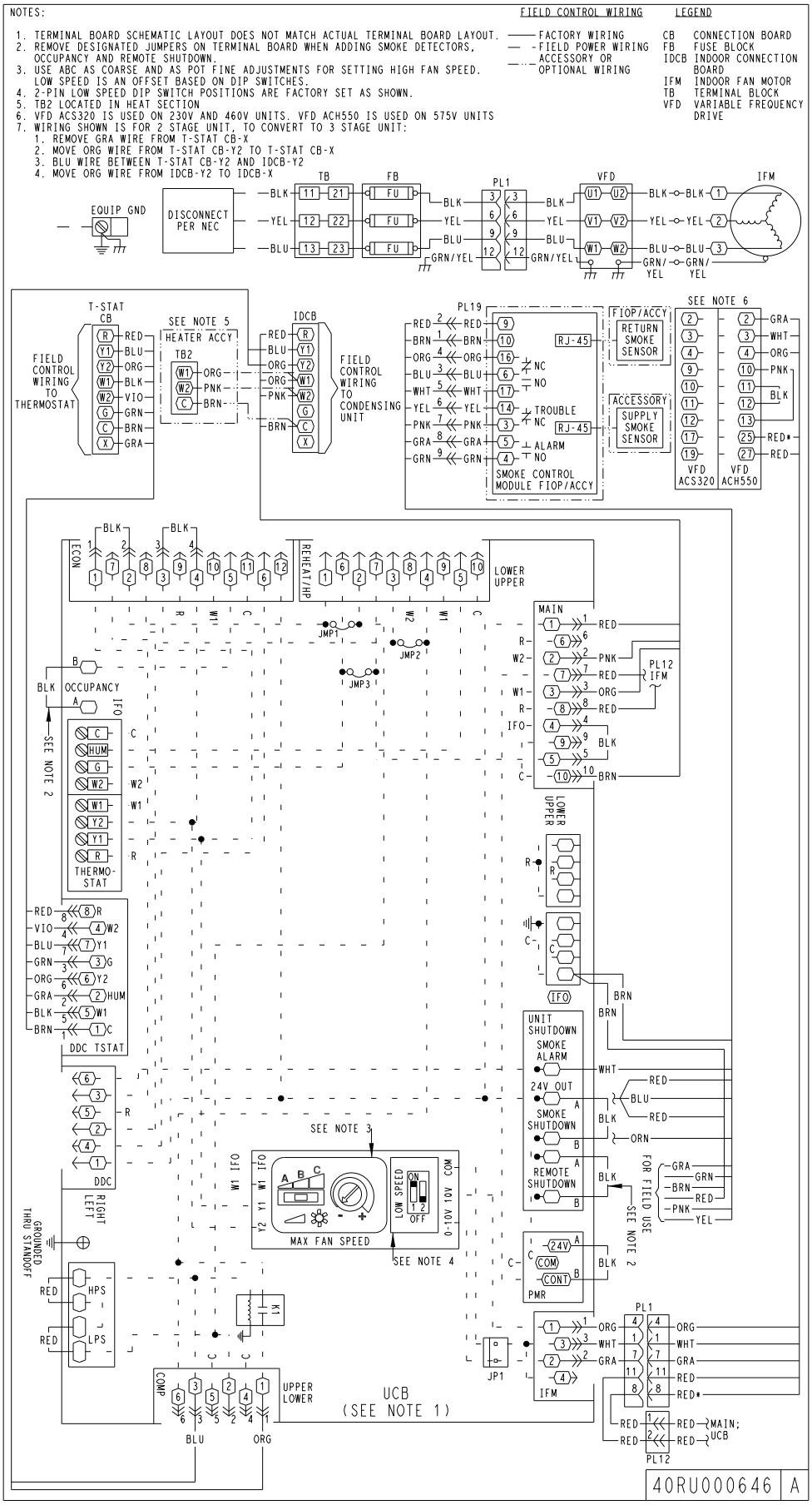


Fig. 13 — Control Box (Cover Removed) (Typical)

FREEZE PROTECTION

On select models, there is a factory-installed and wired temperature switch (P/N 1186852) to protect the compressor(s) in the condensing unit when frost buildup is present on the indoor coil. The temperature switch is used to prevent the compressor(s) from turning on while the indoor coil is frosted. Refer to the unit wiring label diagram for wiring of this switch.



NOTE: On select units, the black and blue IFM wires are reversed.

Fig. 14 — Unit Wiring

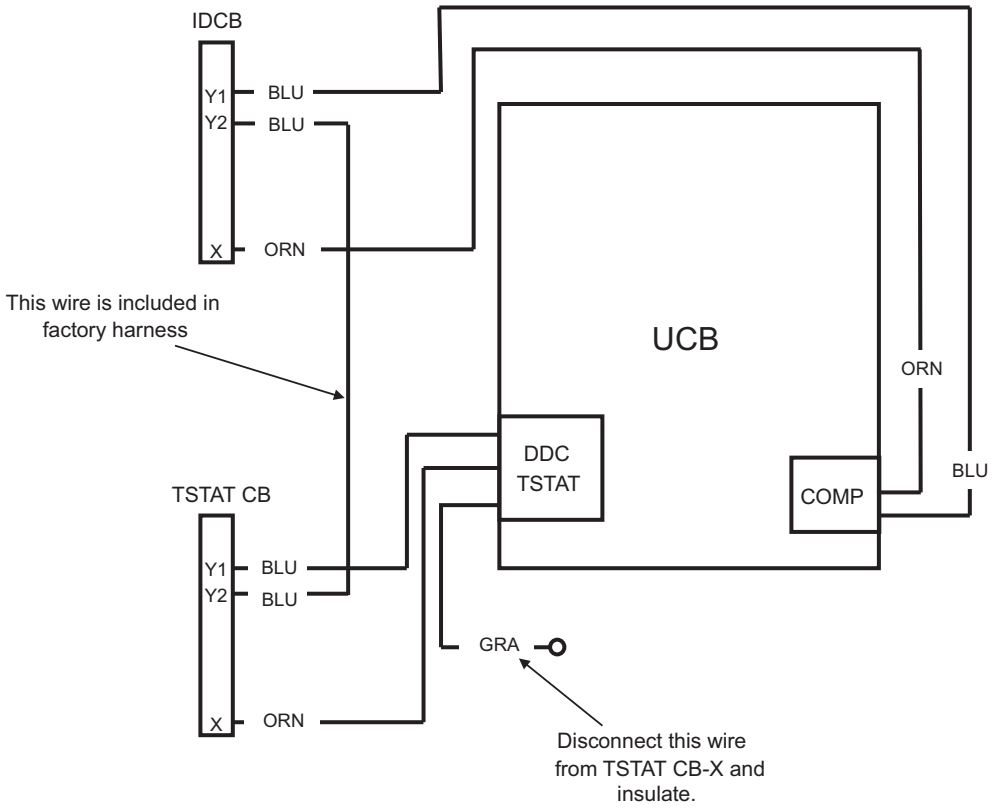


Fig. 15 — 3-Stage Cooling Diagram

Variable Frequency Drive

The unit is equipped with a Variable Frequency Drive (VFD) to control the indoor fan in sequence with the unit's ventilation, cooling, and heating operation. The VFD is controlled through a 0-10vdc signal that is provided by the Unit Control Board (UCB) in the control box. Per ASHRAE 90.1-2016 and IECC-2015 standards, during the first stage of cooling operation, the VFD will adjust the fan motor to provide 66% of the design airflow rate for the unit. When the call for the second stage of cooling is required, the VFD will allow the design airflow rate for the unit established (100%). During heating mode, the VFD will allow total design airflow rate (100%) operation. During ventilation mode, the VFD will operate the fan motor at 66% of full speed.

The ABB ACS320 model (see Fig. 16) is used on 208/230v and 460v units, while the ABB ACH550 model (see Fig. 17) is used on 575v units.

See Fig. 18-19 for location of the VFD.

Fig. 16 — ACS320 Variable Frequency Drive (VFD)

Fig. 17 — ACH550 Variable Frequency Drive (VFD)

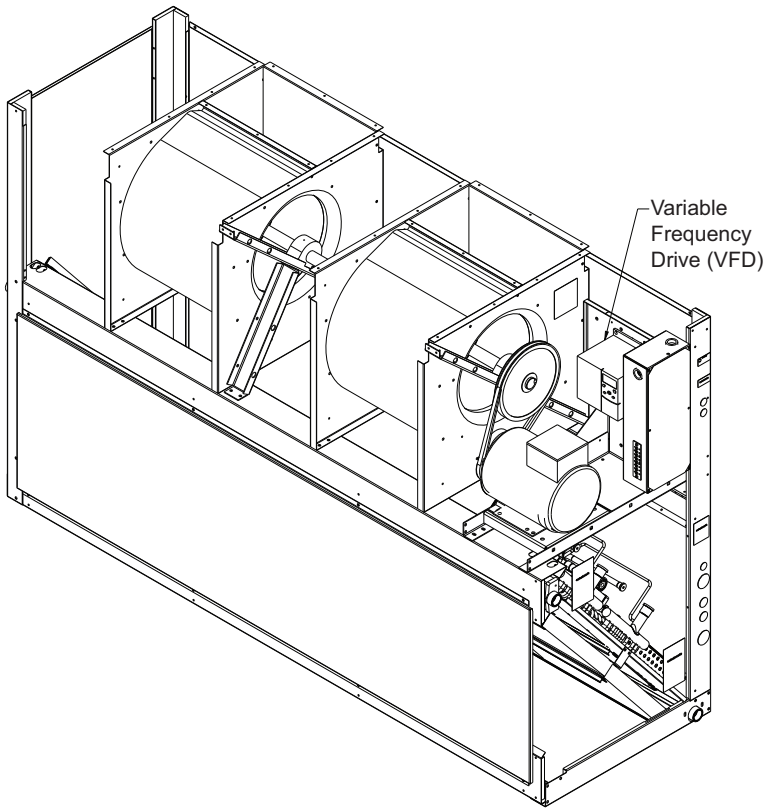


Fig. 18 — ACS320 VFD Location for the following units: FAS150/180, FHS180 (208/230V and 460V only)

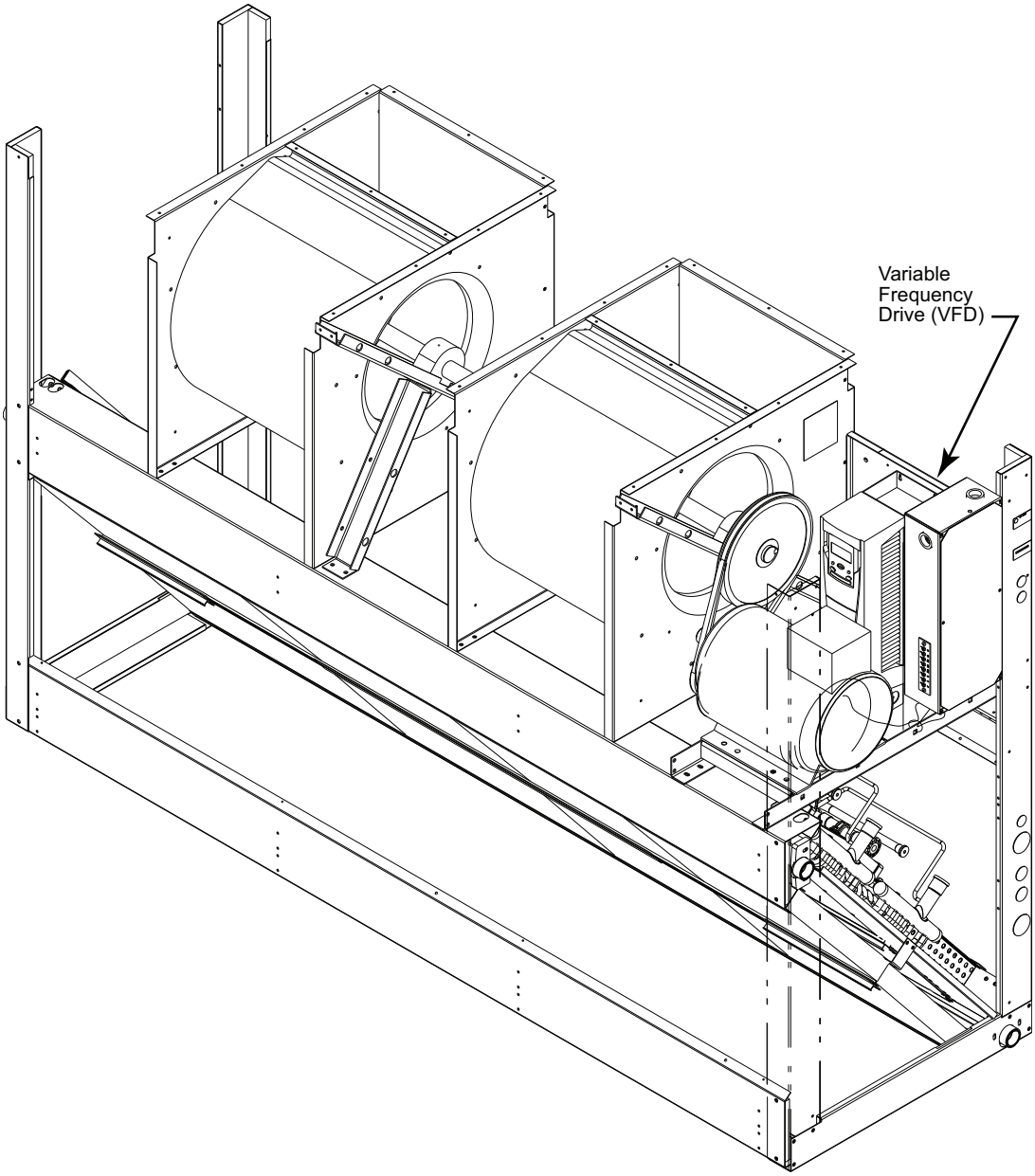


Fig. 19 — ACH550 VFD Location for the following units: FAS150/180, FHS180 (575V only)

Connecting Ductwork

Figure 20 shows recommended duct connection to units with 2 fans.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution could cause equipment damage.

Do not operate unit without ductwork or discharge plenum unless fan speed has been adjusted for external static pressure of 0 in. wg. Failure to do so may result in motor overload.

DISCHARGE CONNECTIONS

Duct flanges are factory-supplied; they are shipped inside the unit attached to the hairpin end of the coil tube sheet for field installation. Using the existing screws, install the duct flanges on the unit's fan deck. Each fan discharge requires 2 flanges; each flange must be bent in the middle to conform to the discharge opening. (See Fig. 21.) After flanges are installed, connect them to the supply duct using a canvas connection to prevent vibration. It is important that this connection be properly fabricated to prevent high air friction losses and air noise.

RETURN CONNECTIONS

When using return-air ductwork, route return-air duct to the unit's return air inlet near the filter rack, using a canvas connection to prevent transmission of unit vibration. If the duct blocks off the unit's access panel, provide a slip joint in the ductwork to permit removal for servicing.

OUTDOOR-AIR INLET CONNECTIONS

Connect outdoor-air inlet to field-installed accessory economizer. Refer to Economizer Installation Instructions.

Return-Air Filters

Type and size of filters are shown in Tables 1-4 and are factory-supplied and factory-installed. In all units with 2 fans, a filter replacement tool (hook) is shipped inside the unit for field use when replacing filters. See the Service section for instructions on filter element replacement.

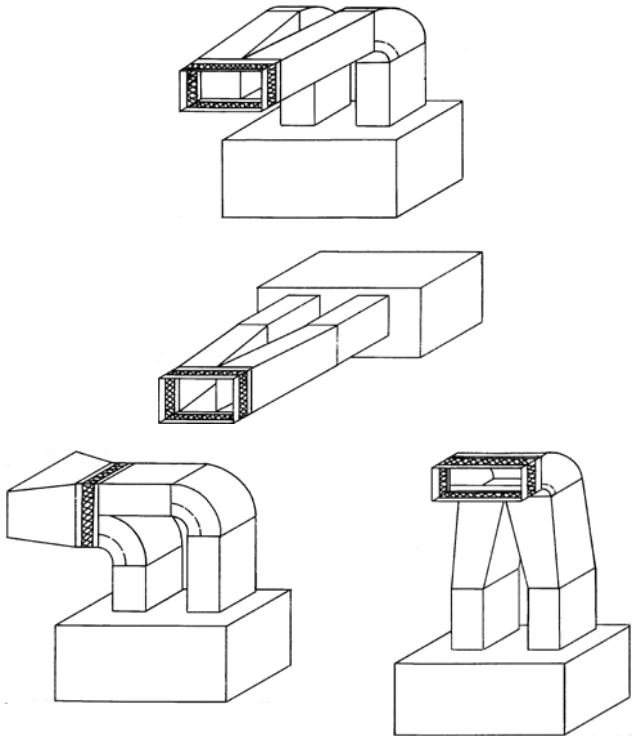


Fig. 20 — Typical Fan Discharge Connections for Multiple Fan Units

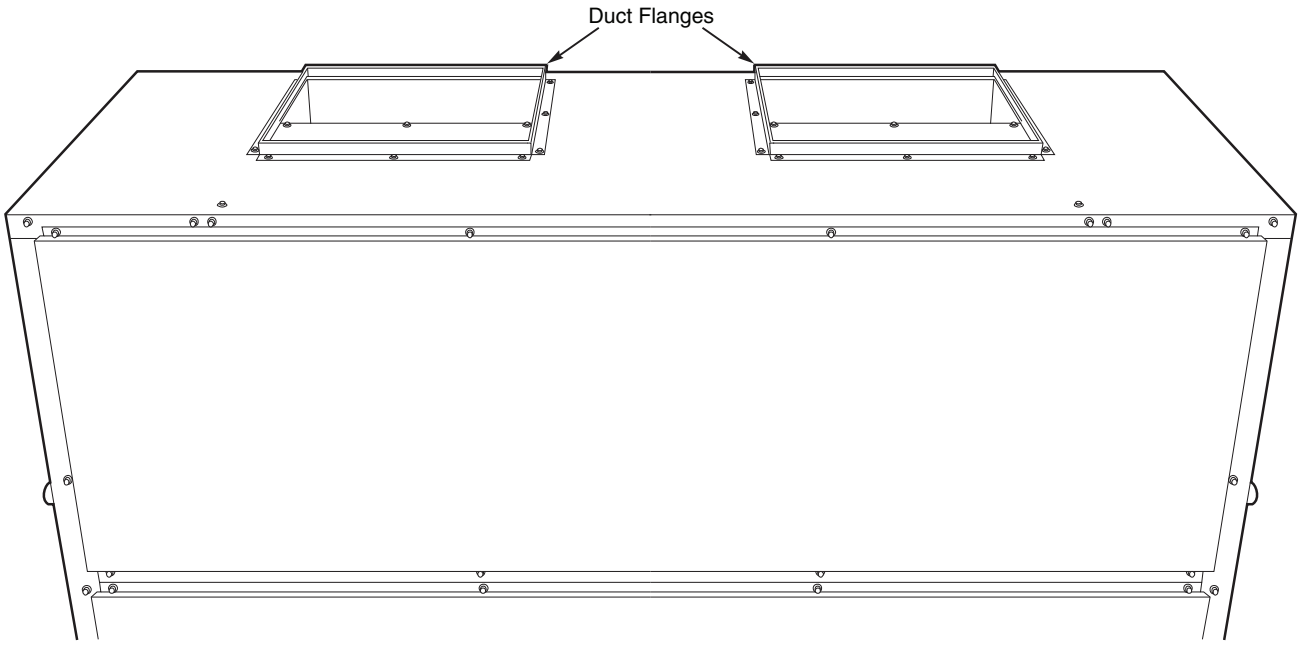


Fig. 21 — Duct Flange Installation

START-UP

Before starting unit, check the following and correct as necessary:

- Is unit solidly supported?
- Is fan adjusted for speed and pulley alignment?
- Are pulleys, motor, and bearings securely mounted?
- Are there any loose parts that will rattle or vibrate?
- Is condensate drain pan pitched for correct drainage?
- Are coil baffle plates tight against coil to prevent air bypass?
- Are all panels securely fastened?
- Are all electrical connections correct and tight?
- Are there any loose or disconnected wires at the VFD or in the control box, or wires in contact with sharp edges or moving parts (pulley, belt)?
- Have all safety, caution, and warning labels been read?

FAS/FHS ONLY

- Is TXV bulb located on suction tube per Fig. 22?
- Is the capillary tube to the bulb free of kinks and not subject to pinching?
- Is the bulb well secured to the suction tube with strap?

Also refer to condensing unit or outdoor heat pump section instructions before starting a split system. A split system start-up checklist is provided at the end of these instructions.

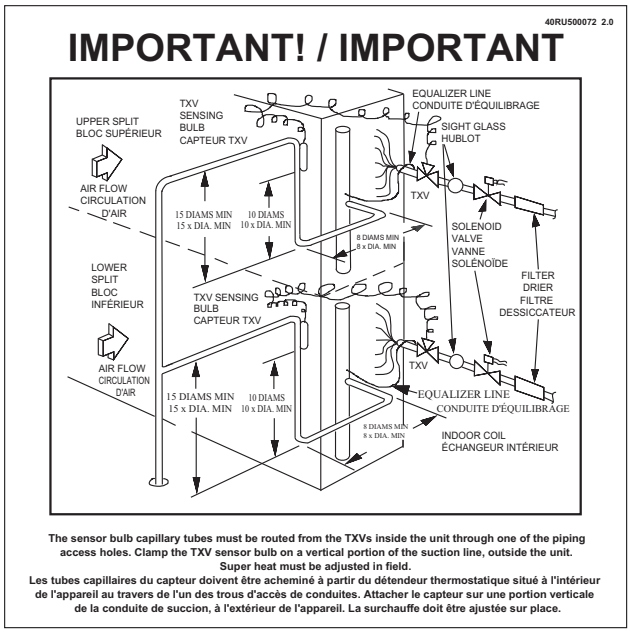


Fig. 22 — TXV Bulb Location Label

Adjusting TXV for Superheat (FAS/FHS only)

The unit-mounted thermostatic expansion valve(s) is/are factory set to provided superheat at the bulb location in 10°F to 15°F (5.5°C to 8.3°C) range. Actual system load conditions may require adjustment of the factory setting. (See Fig. 23.)

To adjust the TXV superheat setting:

1. Remove the seal cap from the bottom of the TXV body.
2. To increase superheat, turn the stem clockwise. To decrease the superheat, turn the stem counterclockwise. Do not turn the stem more than one full turn.
3. Wait until suction pressure and superheat stabilize. This may take more than 30 minutes.
4. Continue adjustment until superheat reaches 10°F to 15°F (5.5°C to 8.3°C).
5. Replace the seal cap; tighten.

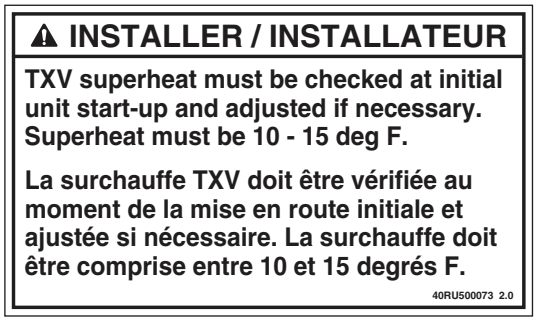


Fig. 23 — TXV Adjustment Label

Compressor Rotation

Follow instructions in Condensing Unit installation instructions. For units equipped with a VFD on the indoor fan motor, the rotation direction of the indoor fan motor and fan cannot be used to visually confirm a correct phase connection to the unit and compressors. Correct phases to equipment for proper compressor rotation. The VFD will maintain the same rotation as input phases are changed. Pressure gages MUST BE USED during cooling system start-up to confirm correct compressor rotation and operation.

Indoor Fan Motor

Raise the cooling set point at the space thermostat to higher than the space temperature. Switch the thermostat's FAN switch to the CONT (Continuous) position. The fan motor will start and run at reduced speed. Check for fan rotation direction. To reverse the fan rotation, disconnect all power to the unit and then switch two motor power leads between the VFD and the motor. Restore unit power and recheck the fan rotation direction.

Check fan motor speed. Motor shaft should be rotating at 1150 to 1180 rpm (19.2 to 19.7 r/s).

Switch the thermostat's FAN switch to AUTO position. Fan motor will stop.

Cooling with 2-Speed Indoor Fan Motor System

FIRST STAGE (Y1)

Set the thermostat FAN switch to AUTO and the SYSTEM switch to COOL. Slowly lower the cooling set point until first stage compressor starts. Indoor fan motor also starts and runs at reduced speed.

SECOND STAGE (Y2)

Lower the cooling set point until the second stage compressor starts. The indoor fan speed is dependent on the number of cooling stages:

- 2-Stage Systems: The indoor fan motor will switch to high speed.
- 3-Stage Systems: The indoor fan motor will remain at low speed.

THIRD STAGE (Y3) — 3-STAGE SYSTEMS ONLY

Lower the cooling set point until the third stage compressor starts. The indoor fan motor will switch to high speed.

Check the fan motor speed. Motor shaft should be rotating at 1725 to 1760 rpm (28.8 to 29.3 r/s).

Confirm compressors are running at correct rotation by checking suction and discharge pressures. To reverse the

compressor rotation, disconnect unit power and switch two of the unit's main power leads. Restore unit power and re-check compressor operation.

Reset thermostat cooling set point to a position above the space temperature.

Both compressors will shut off. Indoor fan motor will stop immediately.

Operating Fan for Test and Balance

During the Test and Balance procedure, it is necessary to operate the supply fan in High Speed without concurrent operation of the Cooling or Heating systems. Use the following procedure to force the fan speed to High.

1. Set the space thermostat to SYSTEM OFF and FAN in AUTO.
2. Disconnect unit power. Lock-out/tag out.
3. Open the fan access panel and remove the cover of control box.
4. Adjust the Low Speed 2-Pin DIP switches on the Unit Control Board. Set both switches to "OFF." This will allow the motor to run at full speed in ventilation only.
5. Locate pressure ports or pitot tubes in the return duct and supply duct to measure external static pressure.
6. Replace control box cover.
7. Restore unit power.
8. Set the space thermostat to FAN CONT.
9. Check the motor speed with stroboscope or similar tool. Motor shaft speed must be in 1725 to 1760 rpm (28.8 to 29.3 r/s) range for High Speed.
10. Replace the fan access panel.
11. Perform test and balance procedure.
12. Adjust the supply fan speed according to the Pulley and Drive Adjustment section to deliver the project selection cfm value. Ensure the selection cfm value is not lower that the "Min cfm Per Fan Motor Type" for this unit-size as found in Table 11. See Fan Speed Set-Up Section on page 23 for alternate method of adjusting supply fan speed through the Unit Control Board.

To restore the unit to ready-to-start condition, disconnect the unit power and lock-out/tag-out, set the space thermostat to FAN AUTO, remove the test pressure ports from the external duct locations, and re-set Low Speed 2-Pin DIP switches to factory setting (refer to wiring diagram on control box cover). Replace the supply fan access panel. Restore unit power.

Table 11 — FAS/FHS Min CFM Per Fan Motor Type

UNIT	2-SPEED FAN MOTOR (AT HIGH SPEED)	2-SPEED FAN MOTOR (AT LOW SPEED)
FAS150	4056	2704
FAS/FHS180	4500	3000

Fan Speed Set Up

These units contain a variable frequency drive (VFD) fan assembly. The fan operates from a 0-10 Vdc signal.

NOTE: The indoor fan motors are equipped with protection relays designed to disable unit operation when a problem is detected. See Typical Wiring Diagram (see Fig. 14) for the red wires in the Indoor fan control.

Fan motor is wired to connect the motor protection relays in series.

UNITS WITH ELECTRO-MECHANICAL CONTROLS

The fan speed set up controls are located on the lower section of the Unit Control Board (UCB). (See Fig. 24.)

The Unit Control Board (UCB) voltage is set for 10 Vdc from the factory to allow for full speed with belt/pulley adjustments.

The following procedure will allow for fan speed reduction if desired.

1. Check the job specifications for the CFM (cubic feet per minute) and ESP (external static pressure) required.
2. Connect a multimeter to the Vdc terminals on the UCB.
3. Set the Range Switch to either A, B, or C per the Switch Range table. A is the lowest speed range, B is the middle speed range and C is the highest speed range.
4. Using a straight blade screwdriver, turn the Vdc control dial to fine tune the Vdc reading until the unit matches the required airflow setting.
5. Record the reading in the Field Setting field.

NOTE: Fan set-up Vdc is not affected by the operating stage of the unit.

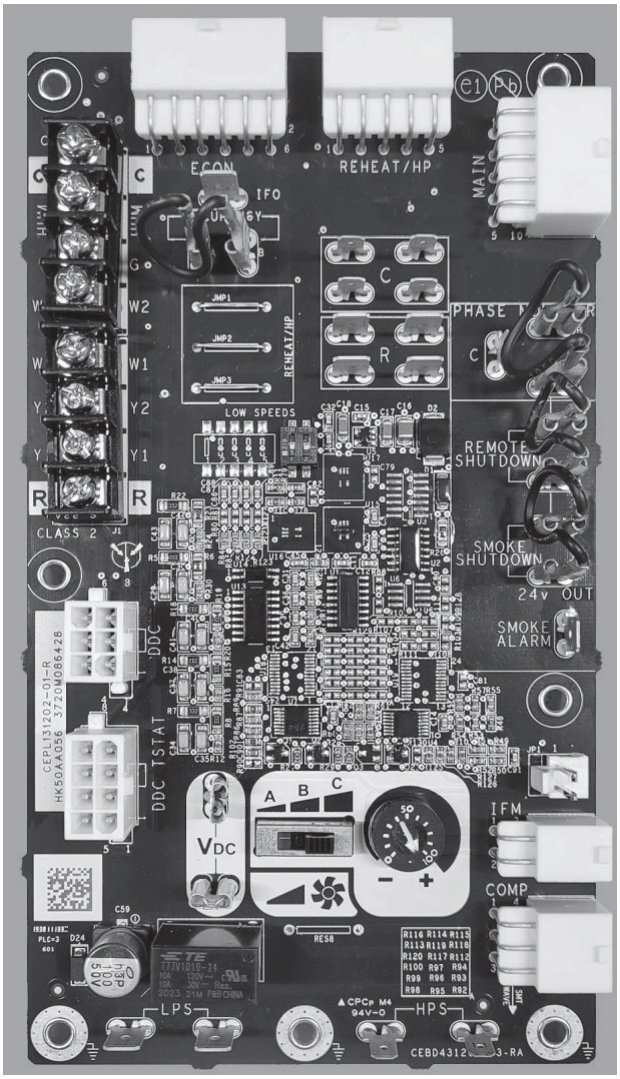


Fig. 24 — Unit Control Board

MAINTENANCE

These items should be part of a routine maintenance program, to be checked every month or two, until a specific schedule for each can be identified for this installation:

Quarterly Inspection (and 30 days after initial start)

INDOOR SECTION

- Condenser coil cleanliness checked.
- Return air filter replacement
- Outdoor hood inlet filters cleaned
- Fan shaft bearing locking collar tightness checked
- Condensate drain checked

Heating

- Power wire connections
- Fuses ready
- Manual-reset limit switch is closed

See Tables 12 and 13 for unit specific maintenance checklists.

Seasonal Maintenance

These items should be checked at the beginning of each season (or more often if local conditions and usage patterns dictate):

AIR CONDITIONING

- Condenser fan motor mounting bolts tightness
- Compressor mounting bolts
- Condenser fan blade positioning
- Control box cleanliness and wiring condition
- Wire terminal tightness
- Refrigerant charge level
- Evaporator coil cleaning
- Evaporator blower motor amperage

Table 12 — Outdoor Unit Maintenance Checklist

MAINTENANCE CHECKLIST[a]	RECOMMENDED INTERVAL[b]	
Outdoor unit specific:	**Monthly**	**Annual**
Clear away debris and vegetation near unit.	X	
Inspect cabinet for damage. Replace components that are damaged or severely rusted.		X
Inspect electrical disconnect for proper function. Repair or replace as necessary.		X
Inspect electrical wiring and connections. Tighten loose connections. Inspect and perform functional test of equipment as needed to ensure proper function. Repair or replace damaged or overheated components and wiring.		X
Check refrigerant system subcooling and superheat.		X
Inspect inside of unit. Clean if debris is present.		X
Inspect condenser coil. Clean if dust, dirt, or debris is present. Rinse unit with fresh water.[c]		X[d]
Inspect motor and fan for damage. Make sure fans spin freely.		X

NOTE(S):

a The above list may not include all maintenance items. Inspection intervals may vary depending on climate and opening hours. Consult your local dealer about a service contact for seasonal inspections.
b Monthly maintenance items and outdoor unit rinsing may be performed by the customer. All other maintenance items and all service work must be performed by a qualified service technician. Read all warning labels.
c Do not use harsh chemicals or high pressure water on coils. More frequent rinsing is required near a sea coast.
d Monthly rinsing of the condenser coil is recommended if the unit is located in a corrosive climate.

Table 13 — Indoor Unit Maintenance Checklist

MAINTENANCE CHECKLIST[a]	RECOMMENDED INTERVAL[b]	
Indoor unit specific: (for accessories refer to unit specific literature)	**Monthly**	**Annual**
Inspect, clean, or replace air filter if dirty.	X	
Inspect and clean blower assembly (includes blower housing, wheel, and motor). Lubricate shaft bearings.		X
Inspect internal and external cabinet. Clean as needed.		X
Inspect electrical disconnect for proper function. Repair or replace as necessary.		X
Inspect electrical components, wiring, and connections. Tighten loose connections. Repair or replace damaged components and wiring.		X
Inspect evaporator coil. Clean if dust, dirt, or debris is present.[c]		X
Clean condensate pan, trap, and drain lines (more frequent maintenance may be required in humid climates — consult your local HVAC dealer).		X
Inspect motor and fan for damage. Make Inspect airflow system (ductwork). Check for leaks and repair as needed.		X

NOTE(S):

a The above list may not include all maintenance items. Inspection intervals may vary depending on climate and opening hours. Consult your local dealer about a service contact for seasonal inspections.
b Monthly maintenance items and outdoor unit rinsing may be performed by the customer. All other maintenance items and all service work must be performed by a qualified service technician. Read all warning labels.
c Do not use harsh chemicals or high pressure water on coils. More frequent rinsing is required near a sea coast.

SERVICE

Inspection and maintenance should be performed at regular intervals and should include the following:

- Complete cleaning of cabinet, fan wheel, cooling coil, condensate pan and drain, heating coils, and return-air grille (if present).
- Inspection of panels and sealing of unit against air leakage.
- Adjustment of fan motor, belt, bearings, and wheels.
- Cleaning or replacement of filters.
- Testing for cooling/heating system leaks.
- Checking of all electrical connections.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before performing service or maintenance operations on unit, always turn off main power switch to unit and install lockout tag. Unit may have more than one power switch.

Most unit service can be performed by removing one or both of the unit's side panels. Coil cleaning, removal or insulation cleaning may require removal of a rear, top, or bottom panel, depending on the unit's orientation. When service is completed, replace unit panels.

Panels

Panels are fastened to unit frame with sheet metal screws. Fan and coil compartment must be sealed tightly after service to prevent air from bypassing the cooling coil.

Fan Motor Lubrication

Fan motor supplied with unit is permanently lubricated and requires no further lubrication.

Fan Shaft Bearings

Sizes 150-180 units have pillow-block bearings (see Fig. 25) that must be lubricated with suitable bearing grease approximately every 3 months. See Table 14 for suitable lubricants.

Table 14 — Lubricant Data

MANUFACTURER	LUBRICANT
Mobil	Mobilplex EP No. 2
Sunoco	Prestige 42
Texaco	Multifak 2
Texaco	Regal AFB – 2[a]

NOTE(S):

a Preferred lubricant, contains rust and oxidation inhibitors.

Centering Fan Wheel

If fan and fan shaft assembly are not properly centered, blades may scrape against the blower side scroll plate or may create an objectionable whistling noise. It may be necessary to adjust individual fan wheels or move entire fan shaft. See the following 2 sections.

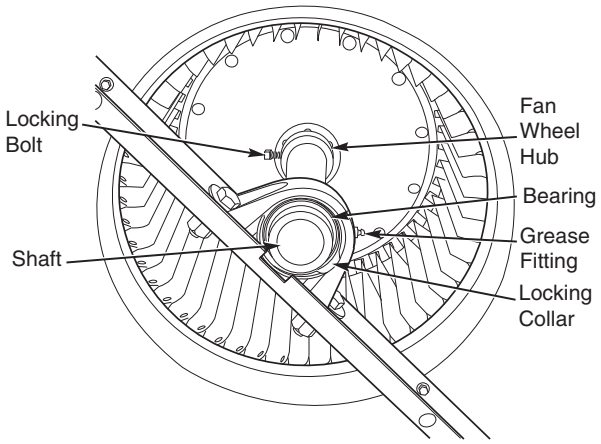


Fig. 25 — Fan Shaft, Bearings, and Fan Wheel (Typical)

Fan Shaft Position Adjustment

Loosen setscrew or locking collar of each fan shaft bearing. Slide shaft into correct position and replace locking collar. (See Fig. 26). To replace locking collar, push collar up against inner face of bearing. Turn collar in direction of fan rotation until tight, and tighten setscrew. Tightening locking collar in direction of fan rotation results in further tightening of collar should setscrew work itself loose.

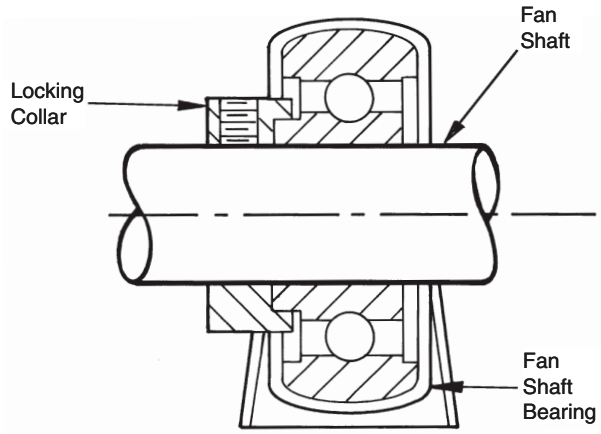


Fig. 26 — Fan Shaft Bearing

Individual Fan Wheel Adjustment

Loosen the 2 locking bolts holding the fan wheel hub to shaft. (See Fig. 25.) Position fan wheel in center of the fan housing and tighten locking bolts. Clearance between wheel and housing should be the same on both sides.

Fan Belts

Motor mounting plate and motor support angles are slotted to permit both vertical and horizontal adjustment. Adjust belt(s) for correct deflection by loosening motor plate mounting bolts, moving motor/plate assembly forward or back, and re-tightening bolts. Press down on belt with one finger midway between fan and motor pulleys to check deflection. For units with motor sizes up to and including 3.7 Hp (2.76 kW), correct deflection is 3/16 in. (4.8 mm). For larger motor sizes, correct deflection is 1/8 in. (3.2 mm). (See Fig. 27.)

If complete belt replacement is required during servicing, loosen the motor plate mounting bolts (Fig. 27), move motor/plate assembly towards fan pulley, and pull belt(s) off pulleys. Reverse the procedure with new bolts and readjust deflection.

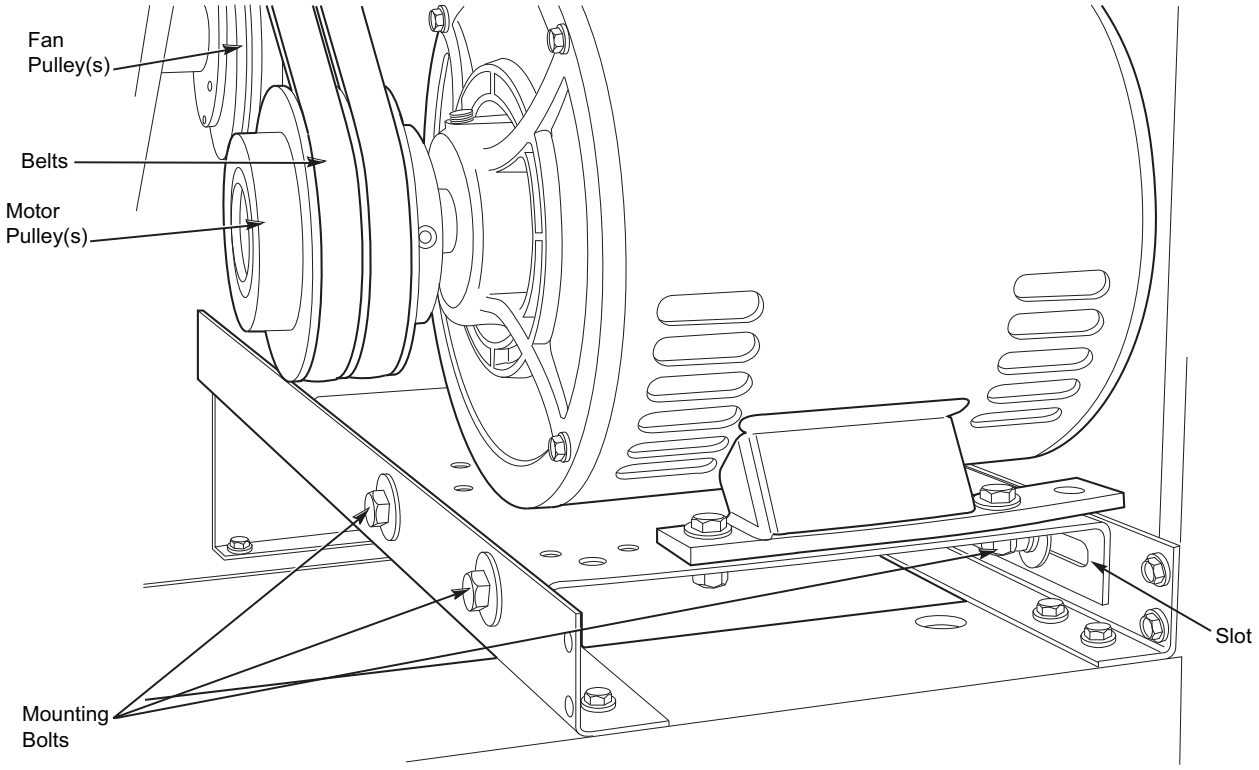


Fig. 27 — Fan Motor Mounting

Fan Rotation

Correct fan rotation with respect to fan outlet is shown in Fig. 28.

To reverse the direction of rotation of a 3-phase fan motor, reverse any 2 of the power leads. Refer to the connection diagram on the inside of motor terminal box cover for proper reversing procedure of a single-phase motor.

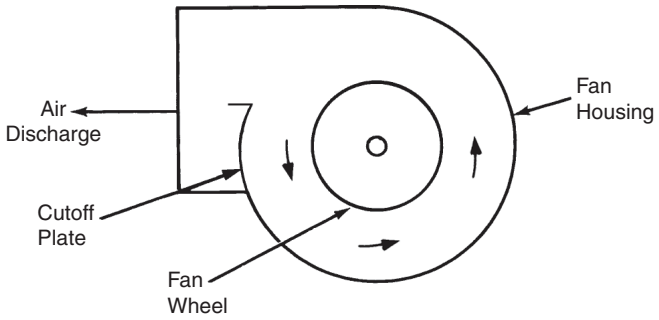


Fig. 28 — Fan Rotation

Fan Pulley Alignment

Align as follows:

1. Loosen setscrews on pulleys.
2. Align pulleys visually and tighten setscrews on fan pulley to lock it in place.
3. Use the methods shown in Fig. 29 to check proper pulley alignment.

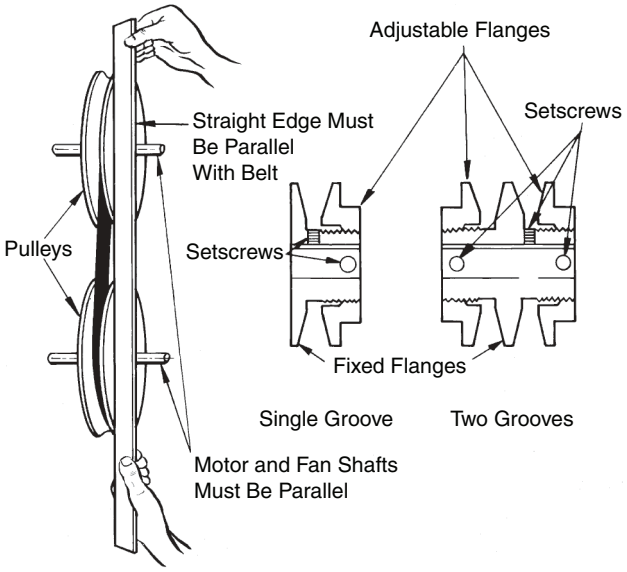


Fig. 29 — Fan Pulley Adjustments

4. If pulleys are not in correct alignment, loosen the motor holddown bolts and slide the motor axially until the pulleys are aligned.
5. Tighten motor holddown bolts.

Pulley and Drive Adjustment

To obtain desired fan speed, refer to the fan motor, drive data and performance data in Tables 15-34 and adjust fan motor pulley as follows:

1. Remove belt from fan motor pulley after loosening motor from motor base.
2. Loosen setscrew in movable flange of pulley. Screw movable flange toward fixed flange to increase the fan speed and away from fixed flange to reduce speed. Before tightening setscrew, make certain that setscrew is over nearest flat surface of pulley hub. (See Fig. 29.)

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution could cause equipment damage.

Increasing fan speed produces a greater load on motor. Do not exceed rated capacity of motor.

Table 15 — Fan Motor Data, FAS Standard Motor, Two Speed — English

UNIT	FAS150	FAS180
208/230-3-60 and 460-3-60		
Speed (rpm)	1735	1750
Hp	2.9	3.7
Frame (NEMA)	56HY	56HY
Shaft Dia (in.)	7/8	7/8
575-3-60		
Speed (rpm)	1710	1710
Hp	3.7	3.7
Frame (NEMA)	56HY	56HY
Shaft Dia (in.)	7/8	7/8

Table 16 — Fan Motor Data, FAS Alternate Motor, Two Speed — English

UNIT	FAS150	FAS180
208/230-3-60 and 460-3-60		
Speed (rpm)	1750	1755
Hp	3.7	5.0
Frame (NEMA)	56HY	184T
Shaft Dia (in.)	7/8	1-1/8
575-3-60		
Speed (rpm)	1755	1755
Hp	5.0	5.0
Frame (NEMA)	184T	184T
Shaft Dia (in.)	1-1/8	1-1/8

Table 17 — Motor Efficiency FAS — Two-Speed Motor

MOTOR HP	EPACT MINIMUM (%)	MOTOR EFFICIENCY (%)
2.4	—	80.0
2.9	—	86.5
3.7	—	83.6
5.0	89.5	89.5

LEGEND

EPACT — Energy Policy and Conservation Act of 1992

Table 18 — Fan Motor Data, FAS Standard Motor, Two Speed — SI

UNIT	FAS150	FAS180
208/230-3-60 and 460-3-60		
Speed (r/s)	28.92	29.17
Shaft kW	2.16	2.76
Frame (NEMA)	56HY	56HY
Shaft Dia (mm)	22.2	22.2
575-3-60		
Speed (r/s)	28.50	28.50
Hp	2.76	2.76
Frame (NEMA)	56HY	56HY
Shaft Dia (mm)	22.2	22.2

Table 19 — Fan Motor Data, FAS Alternate Motor, Two Speed — SI

UNIT	FAS150	FAS180
208/230-3-60 and 460-3-60		
Speed (r/s)	29.17	29.25
Shaft kW	2.76	3.73
Frame (NEMA)	56HY	184T
Shaft Dia (mm)	22.2	28.6
575-3-60		
Speed (r/s)	29.25	29.25
Hp	3.73	3.73
Frame (NEMA)	184T	184T
Shaft Dia (mm)	28.6	28.6

Table 20 — Fan Motor Data, FHS Standard Motor, Two Speed — English

UNIT	FHS180
208/230-3-60 and 460-3-60	
Speed (rpm)	1750
Hp	3.7
Frame (NEMA)	56HY
Shaft Dia (in.)	7/8
575-3-60	
Speed (rpm)	1710
Hp	3.7
Frame (NEMA)	56HY
Shaft Dia (in.)	7/8

Table 21 — Fan Motor Data, FHS Alternate Motor, Two Speed — English

UNIT	FHS180
208/230-3-60 and 460-3-60	
Speed (rpm)	1755
Hp	5.0
Frame (NEMA)	184T
Shaft Dia (in.)	1-1/8
575-3-60	
Speed (rpm)	1755
Hp	5.0
Frame (NEMA)	184T
Shaft Dia (in.)	1-1/8

Table 22 — Motor Efficiency FHS — Two-Speed Motor

MOTOR HP	EPACT MINIMUM (%)	MOTOR EFFICIENCY (%)
1.7	—	82.0
2.4	—	80.0
2.9	—	86.5
3.7	—	83.6
3.7[a]	—	87.9
5.0	89.5	87.9

NOTE(S):

a High Efficiency Motor.

LEGEND

EPACT — Energy Policy and Conservation Act of 1992

Table 23 — Fan Motor Data, FHS Standard Motor, Two Speed — SI

UNIT	FHS180
208/230-3-60 and 460-3-60	
Speed (r/s)	29.17
Shaft kW	2.76
Frame (NEMA)	56HY
Shaft Dia (mm)	22.2
575-3-60	
Speed (r/s)	28.50
Hp	2.76
Frame (NEMA)	56HY
Shaft Dia (mm)	22.2

Table 24 — Fan Motor Data, FHS Alternate Motor, Two Speed — SI

UNIT	FHS180
208/230-3-60 and 460-3-60	
Speed (r/s)	29.25
Shaft kW	3.73
Frame (NEMA)	184T
Shaft Dia (mm)	28.6
575-3-60	
Speed (r/s)	29.25
Hp	3.73
Frame (NEMA)	184T
Shaft Dia (mm)	28.6

Table 25 — Standard Drive Data, 60 Hz — English

UNIT	FAS150	FAS/FHS180
MOTOR DRIVE		
Motor Pulley Pitch Diameter (in.)	2.8-3.8	2.8-3.8
Pulley Factory Setting Full Turns Open	2.5	2.5
FAN DRIVE		
Pulley Pitch Dia (in.)	9.0	9.0
Pulley Bore (in.)	1-1/16	1-1/16
Belt No. — Section	1—A	1—A
Belt Pitch (in.)	42.3	42.3
FAN SPEEDS (rpm)		
Factory Setting	632	632
Range	537-728	537-728
Max Allowable Speed (rpm)	1200	1200
Change per 1/2 Turn of Movable Motor Pulley Flange	19.1	19.1
MAX FULL TURN FROM CLOSED POSITION	5	5
SHAFTS CENTER DISTANCE (in.)	10.44-12.32	10.44-12.32

Table 26 — Medium-Static Drive Data, 60 Hz — English

UNIT	FAS150	FAS/FHS180
MOTOR DRIVE		
Motor Pulley Pitch Diameter (in.)	3.4-4.4	3.7-4.7
Pulley Factory Setting Full Turns Open	2.5	3.0
FAN DRIVE		
Pulley Pitch Dia (in.)	8.2	8.6
Pulley Bore (in.)	1-1/16	1-1/16
Belt No. — Section	1—A	1—B
Belt Pitch (in.)	41.3	41.8
FAN SPEEDS (rpm)		
Factory Setting	820	842
Range	715-926	742-943
Max Allowable Speed (rpm)	1200	1200
Change per 1/2 Turn of Movable Motor Pulley Flange	21.1	16.7
MAX FULL TURN FROM CLOSED POSITION	5	6
SHAFTS CENTER DISTANCE (in.)	10.44-12.32	10.44-1.2.32

Table 27 — High-Static Drive Data, 60 Hz — English

UNIT	FAS150	FAS/FHS180
MOTOR DRIVE		
Motor Pulley Pitch Diameter (in.)	3.7-4.7	4.3-5.3
Pulley Factory Setting Full Turns Open	3.0	3.0
FAN DRIVE		
Pulley Pitch Dia (in.)	7.4	7.9
Pulley Bore (in.)	1-1/16	1-1/16
Belt No. — Section	1—B	1—B
Belt Pitch (in.)	39.8	39.8
FAN SPEEDS (rpm)		
Factory Setting	979	1060
Range	873-1096	950-1171
Max Allowable Speed (rpm)	1200	1200
Change per 1/2 Turn of Movable Motor Pulley Flange	19.4	18.4
MAX FULL TURN FROM CLOSED POSITION	6	6
SHAFTS CENTER DISTANCE (in.)	10.44-12.32[a]	9.16-10.99

NOTE(S):

a 575v unit has a center distance of 9.16-10.99.

Table 28 — Standard Drive Data, 60 Hz — SI

UNIT	FAS150	FAS/FHS180
MOTOR DRIVE		
Motor Pulley Pitch Diameter (mm)	71.1-96.5	71.1-96.5
Pulley Factory Setting Full Turns Open	2.5	2.5
FAN DRIVE		
Pulley Pitch Dia (mm)	229	229
Pulley Bore (mm)	27.0	27.0
Belt No. — Section	1—A	1—A
Belt Pitch (mm)	1074	1074
FAN SPEEDS (r/s)		
Factory Setting	10.5	10.5
Range	9.0-12.1	9.0-12.1
Max Allowable Speed (r/s)	20.0	20.0
Change per 1/2 Turn of Movable Motor Pulley Flange	0.318	0.318
MAX FULL TURN FROM CLOSED POSITION	5	5
SHAFTS CENTER DISTANCE (mm)	265-313	265-313

Table 29 — Medium-Static Drive Data, 60 Hz — SI

UNIT	FAS150	FAS/FHS180
MOTOR DRIVE		
Motor Pulley Pitch Diameter (mm)	86.4-111.8	94.0-119.4
Pulley Factory Setting Full Turns Open	2.5	3.0
FAN DRIVE		
Pulley Pitch Dia (mm)	208	218
Pulley Bore (mm)	27.0	27.0
Belt No. — Section	1—A	1—B
Belt Pitch (mm)	1049	1062
FAN SPEEDS (r/s)		
Factory Setting	13.7	14.0
Range	11.9-15.4	12.4-15.7
Max Allowable Speed (r/s)	20.0	20.0
Change per 1/2 Turn of Movable Motor Pulley Flange	0.352	0.278
MAX FULL TURN FROM CLOSED POSITION	6	6
SHAFTS CENTER DISTANCE (mm)	265-313	265-313

Table 30 — High-Static Drive Data, 60 Hz — SI

UNIT	FAS150	FAS/FHS180
MOTOR DRIVE		
Motor Pulley Pitch Diameter (mm)	94.0-119.4	109.2-134-.6
Pulley Factory Setting Full Turns Open	3.0	3.0
FAN DRIVE		
Pulley Pitch Dia (mm)	188	201
Pulley Bore (mm)	27.0	27.0
Belt No. — Section	1—B	1—B
Belt Pitch (mm)	1011	1011
FAN SPEEDS (R/S)		
Factory Setting	16.3	17.7
Range	14.4-18.3	15.8-19.5
Max Allowable Speed (r/s)	20.0	20.0
Change per 1/2 Turn of Movable Motor Pulley Flange	0.323	0.307
MAX FULL TURN FROM CLOSED POSITION	6	6
SHAFTS CENTER DISTANCE (mm)	265-313[a]	232-279

NOTE(S):

a 575v unit has a center distance of 233-279.

Table 31 — Fan Performance Data — FAS/FHS, 0.0-1.2 in. wg ESP, 60 Hz — English[a,b,c]

UNIT	AIRFLOW (CFM)	EXTERNAL STATIC PRESSURE (in. wg)[d]													
		0.0		0.2		0.4		0.6		0.8		1.0		1.2	
		rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
FAS150	3750	**410**	**0.43**	**467**	**0.55**	567	0.83	649	1.12	721	1.41	788	1.72	851	2.05
	4300	**455**	**0.62**	**504**	**0.74**	599	1.05	679	1.38	748	1.70	811	2.04	871	2.39
	5000	**514**	**0.92**	556	1.06	641	1.39	718	1.76	786	2.14	847	2.52	903	2.91
	5700	575	1.32	612	1.47	686	1.82	759	2.23	825	2.66	884	3.09	939	3.52
	6250	624	1.71	657	1.87	725	2.24	793	2.66	856	3.12	915	3.59	969	4.06
FAS180 FHS180	4500	**437**	**0.61**	**483**	**0.72**	576	1.01	660	1.35	732	1.69	797	2.03	856	2.38
	5300	**499**	**0.95**	538	1.07	617	1.37	696	1.74	767	2.13	830	2.53	888	2.94
	6000	**555**	**1.34**	590	1.48	659	1.79	730	2.17	798	2.59	860	3.04	918	3.49
	6800	620	1.91	651	2.06	712	2.39	774	2.78	836	3.22	896	3.71	952	4.21
	7500	677	2.52	706	2.69	761	3.04	817	3.44	873	3.89	929	4.39	984	4.93

Table 32 — Fan Performance Data — FAS/FHS, 1.4-2.4 in. wg ESP, 60 Hz — English[a,b,c]

UNIT	AIRFLOW (CFM)	EXTERNAL STATIC PRESSURE (in. wg)[d]											
		1.4		1.6		1.8		2.0		2.2		2.4	
		rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
FAS150	3750	912	2.39	971	2.76	1028	3.14	1083	3.54	**1135**	**3.95**	**1185**	**4.36**
	4300	928	2.75	982	3.13	1036	3.53	1087	3.94	**1138**	**4.37**	**1187**	**4.81**
	5000	956	3.30	1007	3.71	1056	4.13	**1104**	**4.56**	**1151**	**5.00**	**1196**	**5.46**
	5700	990	3.96	1039	4.40	1086	4.85	**1130**	**5.31**	**1174**	**5.78**	—	—
	6250	1019	4.54	1067	5.02	**1112**	**5.50**	**1156**	**5.99**	**1198**	**6.49**	—	—
FAS180 FHS180	4500	912	2.75	967	3.12	1019	3.52	1070	3.92	1120	4.35	1168	4.79
	5300	942	3.34	992	3.76	1041	4.18	1088	4.61	1134	5.06	**1179**	**5.52**
	6000	971	3.95	1020	4.40	1067	4.86	1112	5.33	1156	5.81	**1198**	**6.29**
	6800	1005	4.72	1054	5.23	1101	5.75	1145	6.27	**1187**	**6.79**	—	—
	7500	1036	5.48	1084	6.04	1131	6.61	**1174**	**7.17**	—	—	—	—

NOTE(S):

a Maximum allowable fan speed is 1200 rpm for all sizes.
b Fan performance is based on deductions for wet coil, clean 2 in. filters, and unit casing. See table below for factory-supplied filter pressure drop.
c Refer to fan motor and drive tables for additional data.
d **Bold** indicates field-supplied drive is required.
Plain type indicates standard motor and standard drive.
Underlining indicates a different motor and drive combination other than the standard motor and standard drive combination is required. Refer to fan motor and drive tables to complete selection.

Factory-Supplied Pressure Drop — English

UNIT	AIRFLOW (Cfm)	PRESSURE DROP (in. wg)
FAS150	3,750	0.06
	5,000	0.10
	6,250	0.13
FHS150 FHS180	4,500	0.08
	6,000	0.12
	7,500	0.17

LEGEND

bhp — Brake Horsepower Input to Fan
ESP — External Static Pressure

Table 33 — Fan Performance Data — FAS/FHS 0-300 Pa ESP, 60 Hz — SI[a,b,c]

UNIT	AIRFLOW (L/s)	EXTERNAL STATIC PRESSURE (Pa)[d]													
		0		50		100		150		200		250		300	
		r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW
FAS150	1770	**6.84**	**0.32**	**7.78**	**0.41**	9.46	0.62	10.82	0.83	12.02	1.05	13.13	1.28	14.19	1.53
	2030	**7.58**	**0.46**	**8.40**	**0.55**	9.98	0.78	11.31	1.03	12.47	1.27	13.52	1.52	14.51	1.78
	2360	**8.57**	**0.69**	9.27	0.79	10.68	1.04	11.96	1.31	13.09	1.60	14.11	1.88	15.05	2.17
	2690	9.59	0.99	10.20	1.10	11.44	1.36	12.64	1.66	13.74	1.98	14.74	2.30	15.65	2.63
	2950	10.40	1.28	10.96	1.39	12.09	1.67	13.21	1.98	14.27	2.33	15.25	2.68	16.15	3.03
FAS180 FHS180	2120	**7.28**	**0.45**	**8.05**	**0.54**	9.60	0.75	11.00	1.00	12.21	1.26	13.28	1.15	14.27	1.78
	2500	**8.32**	**0.71**	8.97	0.80	10.29	1.02	11.59	1.30	12.78	1.59	13.84	1.89	14.80	2.19
	2830	**9.25**	**1.00**	9.83	1.10	10.99	1.33	12.16	1.62	13.29	1.93	14.34	2.27	15.30	2.60
	3210	10.33	1.42	10.85	1.54	11.87	1.78	12.90	2.07	13.93	2.40	14.93	2.76	15.87	3.14
	3540	11.29	1.88	11.77	2.01	12.69	2.27	13.62	2.56	14.56	2.90	15.49	3.27	16.40	3.67

Table 34 — Fan Performance Data — FAS/FHS 350-600 Pa ESP, 60 Hz — SI[a,b,c]

UNIT	AIRFLOW (L/s)	EXTERNAL STATIC PRESSURE (Pa)[d]											
		350		400		450		500		550		600	
		r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW	r/s	kW
FAS150	1770	15.21	1.78	16.19	2.06	17.13	2.34	18.04	2.64	**18.91**	**2.94**	**19.75**	**3.25**
	2030	15.46	2.05	16.37	2.33	17.26	2.63	18.12	2.94	**18.96**	**3.26**	**19.78**	**3.59**
	2360	15.94	2.46	16.78	2.77	17.60	3.08	**18.40**	**3.40**	**19.18**	**3.73**	**19.94**	**4.07**
	2690	16.51	2.95	17.32	3.28	18.09	3.62	**18.84**	**3.96**	**19.57**	**4.31**	—	—
	2950	16.99	3.39	17.78	3.74	**18.54**	**4.10**	**19.26**	**4.47**	**19.96**	**4.84**	—	—
FAS180 FHS180	2120	15.21	2.05	16.11	2.33	16.98	2.62	17.83	2.93	18.66	3.24	19.47	3.57
	2500	15.93	2.49	16.54	2.80	17.35	3.12	18.14	3.44	18.90	3.77	**19.64**	**4.11**
	2830	16.18	2.94	17.01	3.28	17.79	3.63	18.54	3.97	19.27	4.33	**19.97**	**4.69**
	3210	16.75	3.52	17.57	3.90	18.34	4.29	19.08	4.67	**19.78**	**5.06**	—	—
	3540	17.26	4.09	18.07	4.50	18.84	4.93	**19.57**	**5.35**	—	—	—	—

NOTE(S):

a Maximum allowable fan speed is 20 r/s for all sizes.
b Fan performance is based on deductions for wet coil, clean 51 mm filters, and unit casing. See table below for factory-supplied filter pressure drop.
c Refer to fan motor and drive tables for additional data.
d **Bold** indicates field-supplied drive is required.
Plain type indicates standard motor and standard drive.
Underlining indicates a different motor and drive combination other than the standard motor and standard drive combination is required. Refer to fan motor and drive tables to complete selection.

Factory-Supplied Pressure Drop — SI

UNIT	AIRFLOW (L/s)	PRESSURE DROP (Pa)
FAS150	1750	15
	2350	24
	3950	33
FHS150 FHS180	2100	20
	2800	30
	3500	42

LEGEND

ESP — External Static Pressure

Variable Frequency Drive

The VFD switches the indoor fan motor speed between full/high speed (60 Hz motor operation) and reduced/low speed (40 Hz motor operation), as required by ASHRAE 90.1-2016 and IECC-2015 requirements for two-stage HVAC units. The VFD is factory-configured to match the current and power requirements for each motor selection and all wiring connections are completed by the factory; no field adjustments or connections are necessary.

While the basic VFD retains all of its standard capabilities, the 2-Speed Indoor Fan Motor System application uses only a limited portion of these features to provide a 0-10 VDC input based on thermostat demand to the VFD to control the motor speed. With a ventilation or low cooling demand, the Unit Control Board will provide a VDC input corresponding to 66% of design airflow. With a high cooling or heating demand, the Unit Control Board will provide a VDC input corresponding to 100% of design airflow. The fan control signal is based on control board settings (potentiometer and DIP switches) that are factory-set and thermostat demand to the UCB. While the pulley and drive should be adjusted to obtain desired airflow, the potentiometer on the UCB can be used to fine-tune the airflow setting when the fan is running in high speed.

The VFD is not equipped with a keypad. A keypad is available as an accessory (P/N CRDISKIT001A00) for field-installation or expanded service access to VFD parameter and troubleshooting tables. The accessory keypad can only be used for ACS320 and ACH550 drives. See Tables 35-36 for terminal designations and Fig. 30-31 for wiring. See Appendix A for VFD parameters.

The VFD used in the 2-Speed Indoor Fan Motor System has soft start capabilities to slowly ramp up speeds, eliminating any high in-rush of air volume during speed changes. It also has internal overcurrent protection for the fan motor.

Table 35 — ACS320 VFD Terminal Designations

TERMINAL	FUNCTION
U1 V1 W1	Three-Phase main circuit input power supply
U2 V2 W2	Three-Phase AC output to motor, 0V to maximum input voltage level
2 (AI1) 3 (GND)	Analog input (0-10V)
4	10 VDC Reference Voltage
10 (GND) 11 (COMMON)	Factory-supplied jumper
9 (24 VDC) 12 (DI-1)	Activate to start drive (Start/Stop)
17 (Relay COM) 19 (Relay NO)	Relay Output for Unit Control Board safety chain

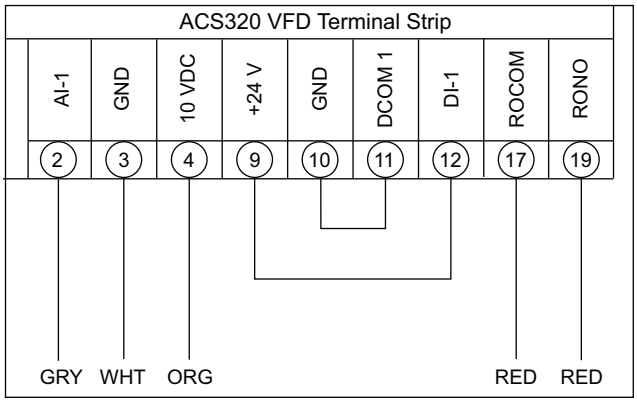


Fig. 30 — ACS320 VFD Wiring

Table 36 — ACH550 VFD Terminal Designations

TERMINAL	FUNCTION
U1 V1 W1	Three-Phase main circuit input power supply
U2 V2 W2	Three-Phase AC output to motor, 0V to maximum input voltage level
2 (AI2) 3 (GND)	Analog input (0-10V)
4	10 VDC Reference Voltage
11 (GND) 12 (COMMON)	Factory-supplied jumper
10 (24 VDC) 13 (DI-1)	Activate to start drive (Start/Stop)
25 (Relay 3 COM) 27 (Relay 3 NO)	Relay Output for Unit Control Board safety chain

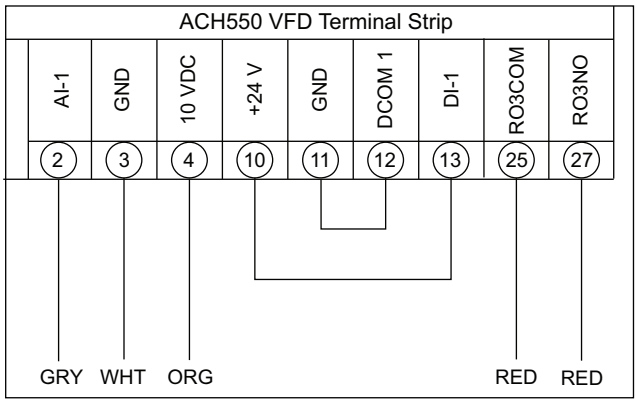


Fig. 31 — ACH550 VFD Wiring

INDOOR FAN MOTOR

The indoor fan motors used with the VFD are specially manufactured for use with VFD power circuits. The motor winding insulation is specially formulated to resist breakdown due to voltage stress issues. The motor shaft includes grounding rings to prevent damage to bearings caused by grounding currents. Replace these motors with Factory Authorized Parts available from Fast Parts.

VFD FUSES

Table 37 details the fuse requirement for the VFD installed in FAS/FHS units. Check the control wiring diagram label on the specific unit in use for the fuse location.

FAN FAULT DETECTION

The Variable Frequency Drive is equipped with a relay internal to the drive that is used to prevent the motor from running if there are faults detected by the VFD. If the FAS/FHS is connected to the condensing unit correctly (refer to Power Supply and Wiring section), then the Unit Control Board will also prevent the thermostat signals from being sent to the condensing unit, preventing compressor(s) from energizing if there is a VFD fault or if the VFD is de-energized.

VFD ALARMS AND FAULTS TROUBLESHOOTING

The VFD has two LEDs on its front panel that indicate VFD operating status. These LEDs are GREEN and RED.

- GREEN LED ON STEADY: Power ON to VFD
- GREEN LED FLASHING: Alarm condition detected
- RED LED ON (Steady or Flashing): Fault condition detected

ALARMS

Alarms are advisory in nature. These indicate a problem has been detected by the VFD's diagnostics but this problem will not require that the VFD and its motor be shut down. Typical fault condition on the 2-Speed Indoor Fan Motor System application might be loose connections at the VFD terminal board or damaged conductors between the Fan Speed Board connector J2 and the VFD terminal strip. See Table 38 for a full list.

CLEAR THE ALARM LED

Shut off power to the VFD for five minutes. Restore power and recheck the GREEN LED. If this LED is still flashing, then connect the accessory remote display keypad kit. Use Table 38 to determine if the alarm requires any corrective action (action is not always required) and address the root cause of the problem.

If diagnostics troubleshooting has determined that the drive is defective during the warranty period, contact us.

FAULTS

A fault is a significant internal situation for the VFD or its motor. If the motor was running when the fault was detected, it was shutdown. See Table 39 for a full list of faults, display codes, and recommended actions.

Clear the Fault LED

The recommended corrective action for faults is shown in Table 39. The VFD can also be reset to remove the fault. If an external source for a start command is selected and is active, the VFD may start immediately after fault reset.

Connect the accessory remote display keypad kit. To reset a fault indicated by a flashing red LED, turn off the power for 5 minutes. To reset a fault indicated by a red LED (not flashing), press RESET from the control panel or turn off the power for 5 minutes. Depending on the value of parameter 1604 (FAULT RESET SELECT), digital input or serial communication could also be used to reset the drive. When the fault has been corrected, the motor can be started.

Table 37 — VFD Fuse Requirements, FAS/FHS Units

UNIT	HP	VOLTAGE	VFD	MOTOR	STANDARIZED FUSE	FUSE P/N	HARNESS WIRE GAUGE[a]
FAS/FHS	2.9	208/230	1190533	1184987	30A - CLASS CC KTK	1190624	10
		460	1190541	1184987	30A - CLASS CC KTK	1190624	10
	3.7	208/230	1190533	1190990	30A - CLASS CC KTK	1190624	10
		208/230	1190533	1185185	30A - CLASS CC KTK	1190624	10
		460	1190544	1190990	20A - CLASS CC KTK	1183776	10
		460	1190544	1185185	20A - CLASS CC KTK	1183776	10
		575	1185198	1184986	10A - CLASS CC KTK	1190626	10
	5	208/230	1190534	1186328	30A - CLASS CC KTK	1190624	10
		460	1190542	1186328	30A - CLASS CC KTK	1190624	10
		575	1185199	1184986	15A - CLASS CC KTK	1190625	10

NOTE(S):

a Harness wire gauge between control box and VFD.

Table 38 — Alarm Codes

ALARM CODE	ALARM NAME IN PANEL	DESCRIPTION AND RECOMMENDED CORRECTIVE ACTION
2001	—	Reserved
2002	—	Reserved
2003	—	Reserved
2004	DIR LOCK	The change in direction being attempted is not allowed. Do not attempt to change the direction of motor rotation, or Change parameter 1003 DIRECTION to allow direction change (if reverse operation is safe).
2005	I/O COMM	Field bus communication has timed out. Check fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). Check communication settings (Group 51 or 53 as appropriate). Check for poor connections and/or noise on line.
2006	AI1 LOSS	Analog input 1 is lost, or value is less than the minimum setting. Check input source and connections. Check the parameter that sets the minimum (3021) and the parameter that sets the Alarm/Fault operation (3001).
2007	AI2 LOSS	Analog input 2 is lost, or value is less than the minimum setting. Check input source and connections. Check parameter that sets the minimum (3022) and the parameter that sets the Alarm/Fault operation (3001).
2008	PANEL LOSS	Panel communication is lost and either the VFD is in local control mode (the control panel displays HAND), or the VFD is in remote control mode (AUTO) and is parameterized to accept start/stop, direction or reference from the control panel. To correct, check the communication lines and connections, Parameter 3002 PANEL LOSS, and parameters in groups 10 COMMAND INPUTS and 11 REFERENCE SELECT (if drive operation is REM).
2009	—	Reserved
2010	MOT OVERTEMP	Motor is hot, based on either the VFD estimate or on temperature feedback. This alarm warns that a Motor Overload fault trip may be near. Check for overloaded motor. Adjust the parameters used for the estimate (3005 - 3009). Check the temperature sensors and Group 35 parameters.
2011	UNDERLOAD	Motor load is lower than expected. This alarm warns that a Motor Underload fault trip may be near. Check that the motor and drive ratings match (motor is NOT undersized for the drive). Check the settings on parameters 3013 to 3015.
2012	MOTOR STALL	Motor is operating in the stall region. This alarm warns that a Motor Stall fault trip may be near.
2013*	AUTORESET	This alarm warns that the drive is about to perform an automatic fault reset, which may start the motor. To control automatic reset, use parameter group 31 (AUTOMATIC RESET).
2014	AUTOCHANGE	This alarm warns that the PFA autochange function is active. To control PFA, use parameter group 81 (PFA) and the Pump Alternation macro.

Table 38 — Alarm Codes (cont)

ALARM CODE	ALARM NAME IN PANEL	DESCRIPTION AND RECOMMENDED CORRECTIVE ACTION
2015	PFA INTERLOCK	This alarm warns that the PFA interlocks are active, which means that the drive cannot start any motor (when Autochange is used), or a speed regulated motor (when Autochange is not used).
2016	—	Reserved
2017*	OFF BUTTON	This alarm indicates that the OFF button has been pressed.
2018	PID SLEEP	This alarm warns that the PID sleep function is active, which means that the motor could accelerate when the PID sleep function ends. To control PID sleep, use parameters 4022 - 4026 or 4122 - 4126.
2019	ID RUN	The VFD is performing an ID run.
2020	OVERRIDE	Override mode is activated.
2021	START ENABLE 1 MISSING	This alarm warns that the Start Enable 1 signal is missing. To control Start Enable 1 function, use parameter 1608. To correct, check the digital input configuration and the communication settings.
2022	START ENABLE 2 MISSING	This alarm warns that the Start Enable 2 signal is missing. To control Start Enable 2 function, use parameter 1609. To correct, check the digital input configuration and the communication settings.
2023	EMERGENCY STOP	Emergency stop is activated.

Table 39 — Fault Codes

FAULT CODE	FAULT NAME IN PANEL	DESCRIPTION AND RECOMMENDED CORRECTIVE ACTION
1	OVERCURRENT	Output current is excessive. Check for excessive motor load, insufficient acceleration time (parameters 2202 ACCELER TIME 1, default 30 seconds), or faulty motor, motor cables or connections.
2	DC OVERVOLT	Intermediate circuit DC voltage is excessive. Check for static or transient over voltages in the input power supply, insufficient deceleration time (parameters 2203 DECELER TIME 1, default 30 seconds), or undersized brake chopper (if present).
3	DEV OVERTEMP	Drive heat sink is overheated. Temperature is at or above 115°C (239°F). Check for fan failure, obstructions in the air flow, dirt or dust coating on the heat sink, excessive ambient temperature, or excessive motor load.
4	SHORT CIRC	Fault current. Check for short-circuit in the motor cable(s) or motor or supply disturbances.
5	OVERLOAD	Inverter overload condition. The drive output current exceeds the ratings.
6	DC OVERVOLT	Intermediate circuit DC voltage is not sufficient. Check for missing phase in the input power supply, blown fuse, or under voltage on main circuit.
7	AI1 LOSS	Analog input 1 loss. Analog input value is less than AI1 FLT LIMIT (3021). Check source and connection for analog input and parameter settings for AI1 FLT LIMIT (3021) and 3001 AI<MIN FUNCTION.
8	AI2 LOSS	Analog input 2 loss. Analog input value is less than AI2 FLT LIMIT (3022). Check source and connection for analog input and parameter settings for AI2 FLT LIMIT (3022) and 3001 AI<MIN FUNCTION.
9	MOT OVERTEMP	Motor is too hot, as estimated by the drive. Check for overloaded motor. Adjust the parameters used for the estimate (3005-3009). Check the temperature sensors and Group 35 parameters.
10	PANEL LOSS	Panel communication is lost and either drive is in local control mode (the control panel displays LOC), or drive is in remote control mode (REM) and is parameterized to accept start/stop, direction or reference from the control panel. To correct check the communication lines and connections. Check parameter 3002 PANEL COMM ERROR, parameters in Group 10: Command Inputs and Group 11:Reference Select (if drive operation is REM).
11	ID RUN FAIL	The motor ID run was not completed successfully. Check motor connections.
12	MOTOR STALL	Motor or process stall. Motor is operating in the stall region. Check for excessive load or insufficient motor power. Check parameters 3010-3012.
13	RESERVED	Not used.
14	EXT FAULT 1	Digital input defined to report first external fault is active. See parameter 3003 EXTERNAL FAULT 1.
15	EXT FAULT 2	Digital input defined to report second external fault is active. See parameter 3004 EXTERNAL FAULT 2.
16	EARTH FAULT	The load on the input power system is out of balance. Check for faults in the motor or motor cable. Verify that motor cable does not exceed maximum specified length.
17	UNDERLOAD	Motor load is lower than expected. Check for disconnected load. Check parameters 3013 UNDERLOAD FUNCTION through 3015 UNDERLOAD CURVE.
18	THERM FAIL	Internal fault. The thermistor measuring the internal temperature of the drive is open or shorted. Contact us.
19	OPEX LINK	Internal fault. A communication-related problem has been detected between the OMIO and OINT boards. Contact us.
20	OPEX PWR	Internal fault. Low voltage condition detected on the OINT board. Contact us.

VFD MAINTENANCE

If installed in an appropriate environment, the VFD requires very little maintenance.

Table 40 lists the recommended routine maintenance.

Table 40 — Maintenance Intervals

MAINTENANCE	INTERVAL
Heat sink temperature check and cleaning	Every 6 to 12 months (depending on the dustiness of the environment)
HVAC control panel battery change	Every ten years

HEAT SINK CLEANING

The heat sink fins accumulate dust from the cooling air. In a normal environment check, the heat sink annually. In a dusty environment, check more often.

Use the following procedure to clean the heat sink on ASC320 VFDs:

1. Turn off and lock out unit power.
2. Insert a small straight blade screwdriver into the slot and press in to release the top cover as shown in Fig. 32.

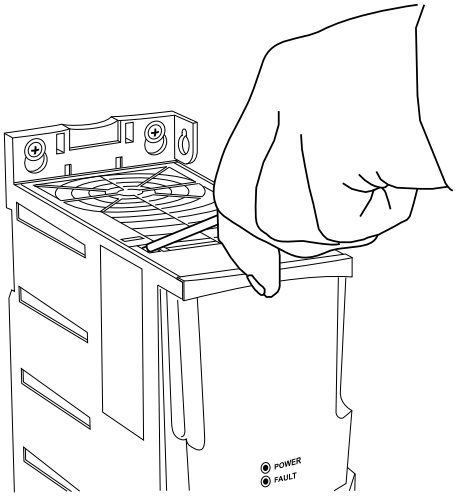


Fig. 32 — Remove Top Cover on ACS320 VFD

3. Blow clean compressed air (not humid) from top of ACS320 while simultaneously using a vacuum cleaner at the base to trap the dust.
4. Replace the top cover.

Restore power.

Use the following procedure to clean the heat sink on AHC550 VFDs:

1. Turn off and lock out unit power.
2. Remove the drive cover (see Fig. 33).
3. Press together the retaining clips on the top cover and lift (see Fig. 34).

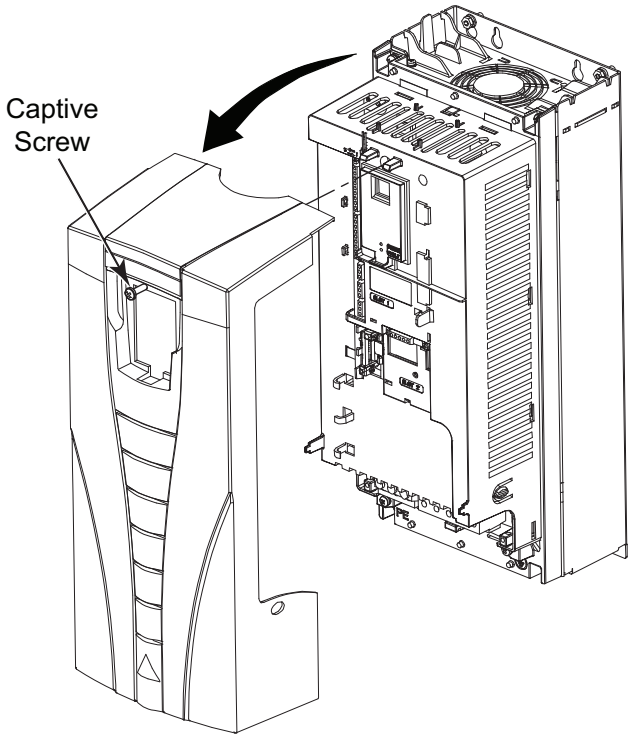


Fig. 33 — Remove ACH550 VFD Front Cover

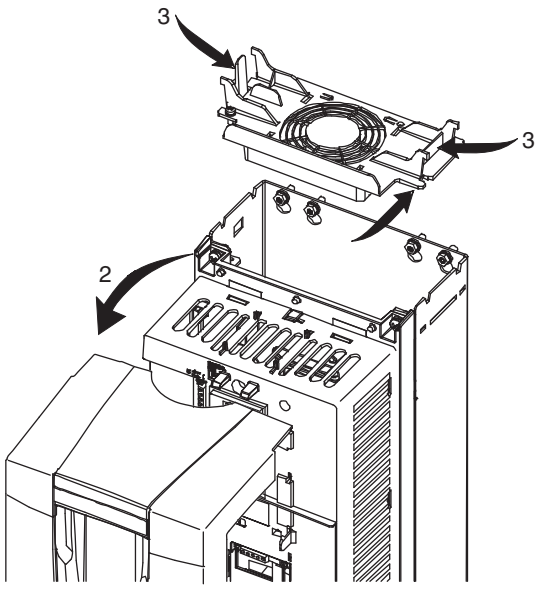


Fig. 34 — Remove Top Cover on ACH550 VFD

4. Blow clean compressed air (not humid) from bottom to top while simultaneously using a vacuum cleaner at the air outlet to trap the dust.
5. Replace the cooling fan.
6. Replace the drive cover.
7. Restore power.

Bypass the VFD

⚠WARNING

Bypassing the VFD is not recommended. This is a temporary procedure to provide cooling or heating operation when a new VFD is required. When in this bypass mode the fire shut down will not turn off the blower and it will continue to run. The bypass should only be used for a short duration until a new VFD has been received.

The factory-installed VFD is wired and agency approved as outlined in this manual. This VFD is utilized to help provide added efficiencies and comfort during the cooling operation.

If there is an occasion where the VFD has malfunctioned and temporary cooling/operation is required, bypass the VFD as shown in Fig. 35.

To bypass VFD:

1. Turn off and lock out unit power.
2. Disconnect the connector linking the fuse to the VFD.
3. Disconnect the connector between the VFD and the indoor fan motor.
4. Disconnect the ground wires at the base of the VFD.
5. Remove the VFD, if required.
6. Connect the lead from the fuse to the lead from the indoor fan motor.
7. Connect the ground wire from the indoor fan motor to the fan deck.
8. Restore power.

Condensate Drains

Keep condensate drains free of dirt and foreign matter.

Return-Air Filters

Refer to Replacing Filters section on page 37 for filter accessibility and removal. Replace with clean filters of the sizes listed in Tables 1-4.

Coil Removal

Remove unit panels and corner posts as required. Disconnect coil connections and remove fastening screws. Remove coil through end or side sections of unit.

Cleaning Cooling Coil

Remove return-air filters. Remove any heavy dirt that may have accumulated on underside of coil. Coil can be cleaned more easily with a stiff brush, vacuum cleaner, or compressed air when coil is dry. If coil is wet or if water is to be used for cleaning, guard against splashing water on electrical components or damaging surrounding area. Clean coil baffles as applicable and check for tight fit to be sure air does not bypass coil.

Cleaning Insulation

The insulation contains an immobilized antimicrobial agent that helps inhibit the growth of bacteria and fungi. Clean the inner surface of the insulation according to the separate maintenance instructions shipped with the unit.

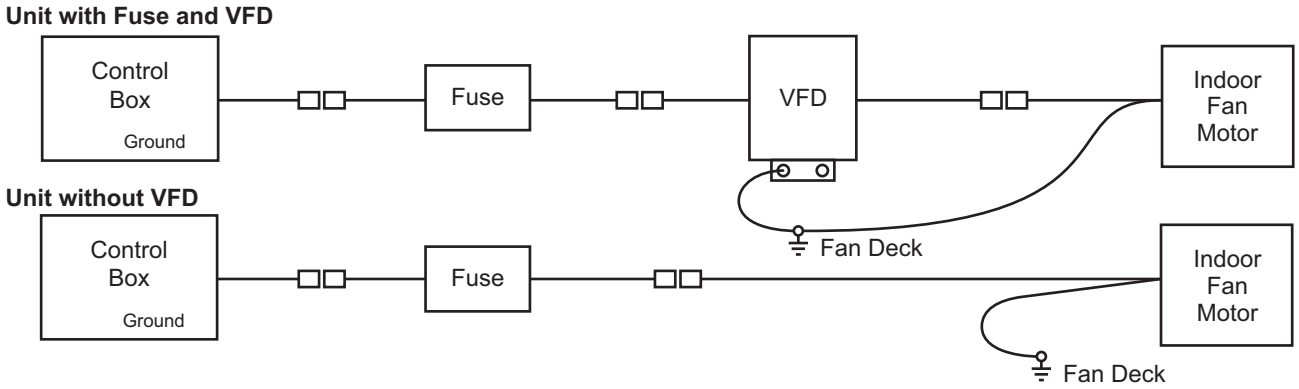


Fig. 35 — To Bypass VFD

Replacing Filters

Filters can be removed and installed from either side of the unit. Install new filters in units that have one fan as follows:

1. Remove the side access panel (retain screws).
2. Remove the filter retainer clip (see Fig. 36).
3. Remove old filters by lifting and tilting them out of the filter track. (See Fig. 12 and 37.)
4. Reverse the procedure to install new filters.

To install new filters in larger units that have 2 fans, follow the preceding steps, but use the factory-supplied filter hook to slide filters within reach for removal. The filter hook is shipped inside the unit in the filter track.

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this CAUTION can result in premature wear and damage to equipment.

DO NOT OPERATE THE UNIT WITHOUT THE RETURN AIR FILTERS IN PLACE.

Dirt and debris can collect on heat exchangers and coils possibly resulting in a small fire. Dirt buildup on components can cause excessive current used resulting in motor failure.

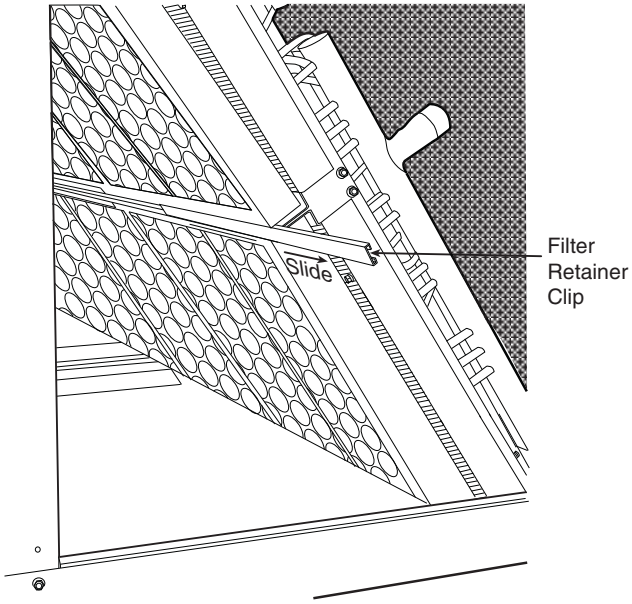


Fig. 36 — Remove Filter Retainer Clip

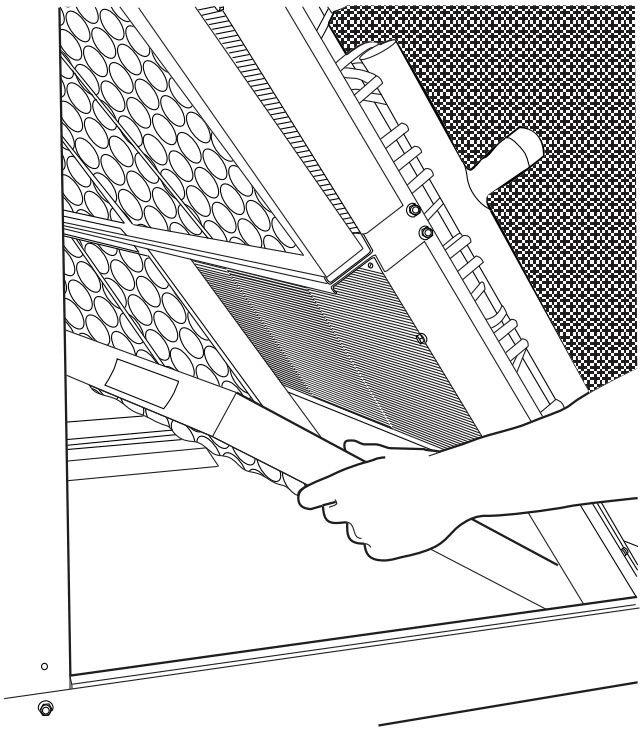


Fig. 37 — Filter Removal/Replacement

APPENDIX A — VFD PARAMETERS

Table A — ACS320 Common Parameters

PARAMETERS	DESCRIPTION	SETTING ACS320
1001	EXT1 Commands	DI1
1102	EXT1/EXT2 Sel	EXT1
1103	REF1 Select	AI-1
1201	Const Speed Sel	DI 2, 3
1202	Const Speed 1	40Hz
1203	Const Speed 2	60Hz
1204	Const Speed 3	60Hz
1205	Const Speed 4	—
1301	Minimum AI1	2%
1401	Relay Output 1	FAULT (–1)
1403	Relay Output 3	—
1501	AO1 Content Sel	—
1601	Run Enable	—
1608	Start Enable 1	Not Sel
1611	Parameter View	3
2007	Minimum Frequency	0.0 Hz
2008	Maximum Frequency	60Hz
2101	Start FCN	Auto
2102	Stop FCN	Coast
2201	Accel/Decel	Not Sel
2202	Accel	30s
2203	DECEL	30s
2603	IR COMP Volt	0
2606	Switching Frequency	4kHz
3102	Trial Time	300.0s
3103	Delay Time	6.0s
3104	AR Overcurrent	Enable
5101	FBA Type	—
5201	Station ID	—
5202	Baud Rate	—
5203	Parity	—
5301	EFB Protocol ID	—
5302	EFB Station ID	—
5303	EFB Baud Rate	—
5304	EFB Parity	—
5305	EFB CTRL Profile	—
9802	COMM Prot Sel	—
9907	Motor Nominal Frequency	60Hz

Table B — ACH550 VFD Common Parameters

PARAMETERS	DESCRIPTION	SETTING ACH550
1001	EXT1 Commands	DI1
1102	EXT1/EXT2 Sel	EXT1
1103	REF1 Select	AI-1
1201	Const Speed Sel	DI 2, 3
1202	Const Speed 1	40Hz
1203	Const Speed 2	60Hz
1204	Const Speed 3	60Hz
1205	Const Speed 4	—
1301	Minimum AI1	2%
1401	Relay Output 1	—
1403	Relay Output 3	FAULT (–1)
1501	AO1 Content Sel	—
1601	Run Enable	—
1608	Start Enable 1	Not Sel
2007	Minimum Frequency	0.0 Hz
2008	Maximum Frequency	60Hz
2101	Start FCN	Auto
2102	Stop FCN	Ramp
2201	Accel/Decel	Not Sel
2202	Accel	30s
2203	DECEL	30s
2606	Switching Frequency	4kHz
3102	Trial Time	300.0s
3103	Delay Time	6.0s
3104	AR Overcurrent	Enable
5101	FBA Type	—
5201	Station ID	—
5202	Baud Rate	—
5203	Parity	—
5301	EFB Protocol ID	—
5302	EFB Station ID	—
5303	EFB Baud Rate	—
5304	EFB Parity	—
5305	EFB CTRL Profile	—
9802	COMM Prot Sel	—
9902	Application Macro	—
9907	Motor Nominal Frequency	60Hz

APPENDIX A — VFD PARAMETERS (cont)

Table C — ACS320 VFD Parameters

VFD PARAMETERS	PKG ABB ACS320	MOTOR PART NO.	VFD PART NO.	DRIVE HP	DESC.	VOLTAGE (9905)	N. AMPS (9906)	MOTOR NOM FREQ (Hz) (9907)	N. RPM (9908)	N. HP (9909)	MAX AMPS (2003)	CROSS REFERENCE EM_PKG
40RU000514-DATA	40RU000514	1185185	1190544	5	FAS/FHS 3.7 HP 460V	460	4.9	60	1725	3.7	5.6	40RU000514
40RU000516-DATA	40RU000516	1184159	1190542	7	FAS/FHS 5.0 HP 460V	460	7.6	60	1760	5.0	8.7	40RU000516
40RU000517-DATA	40RU000517	1184159	1190534	7	FAS/FHS 5.0 HP 230V	230	17.0	60	1760	5.0	19.6	40RU000517
40RU000587-DATA	40RU000587	1184987	1190533	3	FAS/FHS 2.9 HP 230V	230	8.6	60	1725	2.9	9.9	40RU000587
40RU000588-DATA	40RU000588	1184987	1190541	3	FAS/FHS 2.9 HP 460V	460	3.8	60	1725	2.9	4.4	40RU000588
40RU000589-DATA	40RU000589	1185185	1190533	5	FAS/FHS 3.7 HP 230V	230	10.8	60	1725	3.7	12.4	40RU000589

Table D — ACH550 VFD Parameters

VFD PARAMETERS	PKG ABB ACS550	MOTOR PART NO.	VFD PART NO.	DRIVE HP	DESC.	VOLTAGE (9905)	N. AMPS (9906)	MOTOR NOM FREQ (Hz) (9907)	N. RPM (9908)	N. HP (9909)	MAX AMPS (2003)	CROSS REFERENCE EM_PKG
40RU000513-DATA	40RU000513	1184986	1185198	5.0	FAS/FHS 3.7 HP 575V	575	4.9	60	1725	3.7	5.6	40RU000513
40RU000515-DATA	40RU000515	1184986	1185199	7.5	FAS/FHS 5.0 HP 575V	575	8.0	60	1745	5.0	9.2	40RU000515

Lewisburg, TN 37091 USA

Replaces: FAS-FHS-072-180-01SI

START-UP CHECKLIST

(SPLIT SYSTEMS WITH FAS/FHS UNITS)

NOTE: To avoid injury to personnel and damage to equipment or property when completing the procedures listed in this start-up checklist, use good judgment, follow safe practices, and adhere to the safety considerations/information as outlined in preceding sections of this Installation, Start-Up, and Service document.

I. PRELIMINARY INFORMATION

OUTDOOR: MODEL NO. _____ INDOOR: MODEL NO. _____

SERIAL NO._____ SERIAL NO. _____

ADDITIONAL ACCESSORIES _____

II. PRE-START-UP

OUTDOOR UNIT

IS THERE ANY SHIPPING DAMAGE? (Y/N)_____

IF SO, WHERE:_____

_____

WILL THIS DAMAGE PREVENT UNIT START-UP? (Y/N)_____

CHECK POWER SUPPLY. DOES IT AGREE WITH UNIT? (Y/N)_____

HAS THE GROUND WIRE BEEN CONNECTED? (Y/N)_____

VERIFY GROUND INTEGRITY WITH CONTINUITY TEST. (Y/N)_____

HAS THE CIRCUIT PROTECTION BEEN SIZED AND INSTALLED PROPERLY? (Y/N)_____

ARE THE POWER WIRES TO THE UNIT SIZED AND INSTALLED PROPERLY? (Y/N)_____

HAVE COMPRESSOR HOLDDOWN BOLTS BEEN LOOSENED? (Y/N)_____

CONTROLS

ARE THERMOSTAT(S) AND INDOOR FAN CONTROL WIRING CONNECTIONS MADE AND CHECKED? (Y/N)_____

ARE ALL WIRING TERMINALS (including main power supply) TIGHT? (Y/N)_____

HAVE OUTDOOR UNIT CRANKCASE HEATERS BEEN ENERGIZED FOR 24 HOURS? (Y/N)_____

INDOOR UNIT

HAS WATER BEEN PLACED IN DRAIN PAN TO CONFIRM PROPER DRAINAGE? (Y/N)_____

ARE PROPER AIR FILTERS IN PLACE? (Y/N)_____

HAVE FAN AND MOTOR PULLEYS BEEN CHECKED FOR PROPER ALIGNMENT? (Y/N)_____

DO THE FAN BELTS HAVE PROPER TENSION? (Y/N)_____

PIPING

FAS/FHS

HAS FOAM SHIPPING BLOCK BEEN REMOVED FROM THE TXV (Thermostatic Expansion Valve)? (Y/N)_____

ARE LIQUID LINE SOLENOID VALVES LOCATED AT THE INDOOR UNIT (FAS/FHS) OR OUTDOOR UNIT (CAS/CHS) COILS AS REQUIRED? (Y/N)_____

HAVE LEAK CHECKS BEEN MADE AT COMPRESSORS, CONDENSERS, INDOOR COILS, TXVs (Thermostatic Expansion Valves) SOLENOID VALVES, FILTER DRIERS, AND FUSIBLE PLUGS WITH A LEAK DETECTOR? (Y/N)_____

LOCATE, REPAIR, AND REPORT ANY LEAKS. _____

HAVE ALL COMPRESSOR SERVICE VALVES BEEN FULLY OPENED (BACKSEATED)? (Y/N)_____

ARE THE COMPRESSOR OIL SIGHT GLASSES SHOWING CORRECT LEVELS? (Y/N)_____

CHECK VOLTAGE IMBALANCE

LINE-TO-LINE VOLTS: AB_____ V AC_____ V BC_____ V

(AB + AC + BC)/3 = AVERAGE VOLTAGE =_____ V

MAXIMUM DEVIATION FROM AVERAGE VOLTAGE = _____V

VOLTAGE IMBALANCE = 100 X (MAX DEVIATION)/(AVERAGE VOLTAGE) =_____

IF OVER 2% VOLTAGE IMBALANCE, DO NOT ATTEMPT TO START SYSTEM!

CALL LOCAL POWER COMPANY FOR ASSISTANCE.

III. START-UP

CHECK INDOOR FAN MOTOR SPEED AND RECORD.

AFTER AT LEAST 10 MINUTES RUNNING TIME, RECORD THE FOLLOWING MEASUREMENTS:

	COMP A1	COMP B1
OIL PRESSURE	_____	_____
SUCTION PRESSURE	_____	_____
SUCTION LINE TEMP	_____	_____
DISCHARGE PRESSURE	_____	_____
DISCHARGE LINE TEMP	_____	_____
ENTERING OUTDOOR UNIT AIR TEMP	_____	_____
LEAVING OUTDOOR UNIT AIR TEMP	_____	_____
INDOOR UNIT ENTERING AIR DB TEMP	_____	_____
INDOOR UNIT ENTERING AIR WB TEMP	_____	_____
INDOOR UNIT LEAVING AIR DB TEMP	_____	_____
INDOOR UNIT LEAVING AIR WB TEMP	_____	_____
COMPRESSOR AMPS (L1/L2/L3)	____/____/____	____/____/____

CHECK THE COMPRESSOR OIL LEVEL SIGHT GLASSES: ARE THE SIGHT GLASSES SHOWING OIL LEVEL AT 1/8 to 1/3 FULL? (Y/N)_____

NOTES:

_____

_____

_____

_____

_____

_____

Replaces: FAS-FHS-072-180-01SI